

# PROCEEDINGS

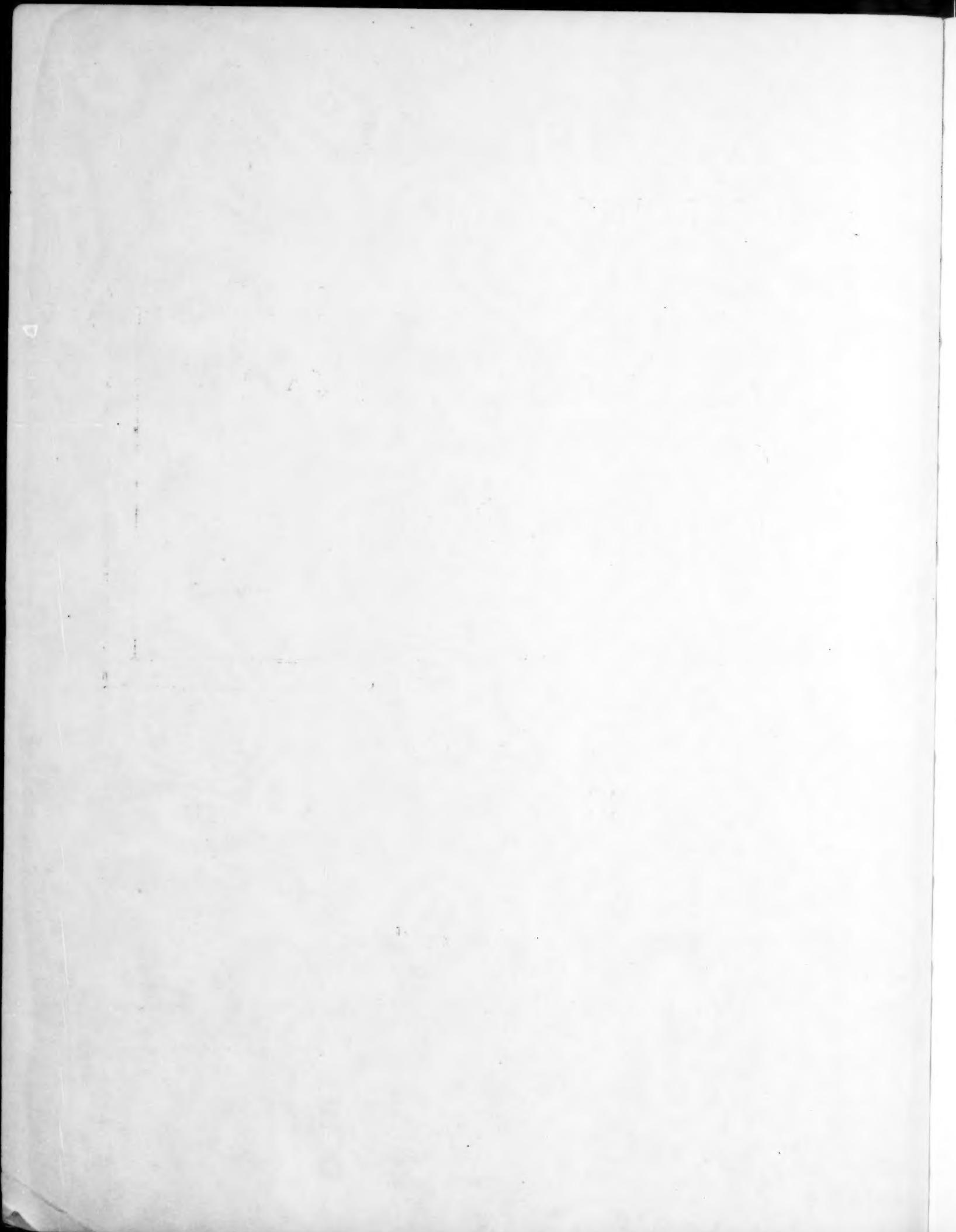
---

---

## TEACHERS' SEMINAR ON PHARMACY

1955

Held under the auspices of the  
American Association of Colleges  
of Pharmacy at the College of  
Pharmacy Butler University,  
Indianapolis, Aug. 7-12, 1955



Proceedings of the  
**TEACHERS' SEMINAR**  
ON  
**PHARMACY**

August 7-12, 1955  
Under the  
Auspices of the American  
Association of Colleges of  
Pharmacy  
at  
Butler University  
College of Pharmacy  
Indianapolis

The Teachers' Seminars are Supported  
by  
The American Foundation for Pharmaceutical Education  
1955

Proceedings of the  
TECHNICAL SEMINAR  
ON  
HYDRAULICS

1960-61

Volume I

Hydraulics  
Principles  
Applications

Volume II

Hydraulics  
Principles  
Applications

2001

## FOREWORD

This volume contains the principal papers together with some supplements and discussion summaries from the Seventh Annual Teachers' Seminar, held at Butler University College of Pharmacy August 7 to 12, 1955. Tape recordings were made of all the workshop sessions, and these have been transcribed. However, the Committee anticipated that the budget would not permit the inclusion of all this material. Therefore, summary reports were provided in the program at the end of each Workshop period. It is regretted that more material could not be printed.

The Committee is grateful to the American Foundation for Pharmaceutical Education for its continued support of these Seminars. The seminars are an important activity of the American Association of Colleges of Pharmacy. There is no gainsaying the wholesome effect they are having upon the quality of our teaching.

A copy of these Proceedings is being sent to each Dean, each college library and every teacher who registered. Certain other individuals and firms also will receive copies.

The Committee extends its thanks to all those who contributed their excellent papers, and those who assisted in the workshop sessions. All were important to the success of the Seminar.

Finally, the Committee wishes to thank all the Seminarians for giving their time to attend this program. Some 186 people registered during the week. The Committee was especially gratified that so many "new faces" were among those present.

The Butler University College of Pharmacy appreciates the opportunity and honor of being selected host for this occasion. The many kind letters which have come in since the Seminar indicate that it was well received. For all these comments, the Committee, and Butler University hereby express their thanks.

One of the non-pharmacist speakers before leaving asked for a word with the Chairman. His comments went something like this: "I have attended several meetings of teachers, in various professions. They have had the same announced purpose--to improve teaching; but this is the first meeting at which the participants really seemed to want to learn how to better their efforts." Your Committee regards this not only as a high compliment to all Seminarians, but as a vote of confidence in the effectiveness and value of the Seminars.

K. L. Kaufman, Chairman

## PROGRAM

### Teachers' Seminar on Pharmacy

Sunday, August 7

Honorary Chairman-E. H. Niles  
Presiding-Dean K. L. Kaufman  
Address of Welcome-Dr. M. O.  
Ross, President, Butler U.  
Greetings from the American  
Foundation for Pharmaceutical  
Education-Dr. W. Paul Briggs,  
Director, A.F.P.E.  
Greetings from the American Assoc-  
iation of Colleges of Pharmacy,  
Dean L. F. Tice, Pres. A.A.C.P.  
The 1955 Pharmacy Seminar-Dean  
Joseph Sprowls, Temple U.

Monday, August 8  
THE TEACHER OF PHARMACY

Presiding-Dean L. F. Tice  
Fundamental Learning Concepts-  
Dr. Roger Coulson, Ass't, Prof.,  
Education, Butler U.  
Fundamental Teaching Concepts-  
Dr. R. R. Armacost, Prof. Bio-  
logical Sciences, Purdue U.  
The Teacher and Professional  
Attitudes-Dean Stephen Wilson  
Wayne U.  
The Teacher and Public Relations  
Dean T. C. Daniels, U. of Calif  
General Discussion of Papers  
Workshop Sessions:  
Section A: Teachers of Intro-  
ductory Courses  
Presiding, Dean T. D. Rowe  
Discussion Leaders-Neuroth,  
Grosicke  
Section B: Teachers of Advanced  
Undergraduate Courses  
Presiding--Dean J. B. Sprowls  
Discussion Leaders-Greco, Sperandio  
Reports of Workshop Sessions  
Presiding-L. F. Tice  
Section A: Dean T. D. Rowe  
Section B: Dean J. B. Sprowls  
General Discussion

Tuesday, August 9

THE UNDERGRADUATE PROGRAM  
Presiding-E. J. Rowe  
Teaching Arithmetical Concepts-  
Dr. Jas. Kearns, Rutgers U.  
Pharmacy Laboratory Instruction-  
Dr. Earl Guth, Ohio State U.  
Nature and Purpose of History of  
Pharmacy Courses-Dr. Glenn  
Sonnedeker, U. of Wisconsin  
Construction and Administration  
of Tests--Dr. J. T. Hastings,  
U. of Illinois, C. of Education  
Workshop Sessions:

Section A: Teachers of Pharmaceu-  
tical Arithmetic  
Presiding-Dr. Jas. Kearns  
Discussion Leaders-Boenigk, Sica  
Section B: Laboratory Instruction  
Presiding-Dr. Earl Guth  
Discussion Leaders-Darlington,  
Salisbury  
Section C: History Teachers  
Presiding-Dr. Glenn Sonnedeker  
Discussion Leaders--Lee, Osborne  
Reports and Discussions as on Mon.  
Presiding-Dr. E. J. Rowe  
Section A: Dr. Kearns  
Section B: Dr. Guth  
Section C: Dr. Sonnedeker  
General Discussion

Wednesday, August 10  
THE UNDERGRADUATE PROGRAM

Presiding-J. B. Sprowls  
Physical Science in Relation to  
Pharmacy Courses, Dr. Higuchi,  
U. of Wis.  
Physical Pharmacy-Dr. A.N. Martin  
Temple U.  
Pharmaceutical Technology  
Courses, An Overview-Dr. E. J.  
Rowe, Butler U.  
Professional Electives-Dean Tom  
Rowe, U. of Michigan  
Workshop Sessions:  
Section A: Teachers of Professional

Electives  
Presiding-Dean Rowe  
Discussion Leaders-Brodie, Thompson  
Section B: Physical Pharmacy Teachers  
Presiding-Dr. A. N. Martin  
Discussion Leaders-Marcus, J.W. Martin, Autian  
Section C: Pharmaceutical Technology Teachers  
Presiding-E.J. Rowe  
Discussion Leaders-Bingenheimer Lloyd, Osborne  
Reports and Discussions  
Presiding-Dean Joseph Sprowls  
Section A: Dean Rowe  
Section B: Dr. A. N. Martin  
Section C: Dr. Rowe

Thursday, August 11  
THE UNDERGRADUATE PROGRAM  
Presiding-Dean T. C. Daniels  
Dispensing Pharmacy Courses, Dr. C.V. Netz, U. of Minn.  
Hospital Pharmacy and Hospital Pharmacy Administration, Prof. Herbert Flack, Jefferson Hospital and Philadelphia C. of Ph. Opening Session of Seminar  
Manufacturing Pharmacy Courses, Prof. Henry Bauman, U. of Iowa  
Ethics and Professional Relations Courses-Jean J. McCloskey, Loyola House  
Workshop Sessions:  
Section A: Dispensing Teachers  
Presiding, Dr. Netz  
Discussion Leaders, Brodie, Wurster  
Section B: Hospital Pharmacy and Hospital Pharmacy Admin. Presiding-Prof. Flack  
Discussion Leaders-Beck, Plein  
Section C: Manufacturing Pharm. Presiding-Prof. Bauman  
Discussion Leaders-Bhatia, Clark  
Section D: Ethics and Professional Relations Presiding-Dean McCloskey  
Discussion Leaders-Belcastro Ferring  
Reports, Discussion and Summary Presiding-Dean T. C. Daniels

Friday, August 12  
GRADUATE STUDY IN PHARMACY  
Presiding-K. L. Kaufman  
Forum: Recruitment for Graduate Study in Pharmacy, Speakers-Dean L.F. Tice, PCP&S, Dr. L. W. Busse, U. of Wisconsin  
Forum: The Nature of Graduate Study in Pharmacy, Speakers-Dr. Wm. Husa, U. of Florida, Dr. Elmer Plein, U. of Wash.  
A Graduate Program in Hospital Pharmacy-L. C. Zopf, S. U. of Iowa  
A Graduate Program in Manufacturing Pharmacy, Dr. Albert Mattocks, U. of Mich  
A Graduate Program for Teachers of Pharmacy-Dean Glenn L. Jenkins Purdue U.  
General Summary and Review of Seminar-Dr. Melvin Green, Director Educational Relations A.C.P.E.

#### Women's Program

Sunday, August 7  
Tea for Women-Holcomb Garden

Monday, August 8  
Hostesses-Butler Pharmacy Faculty Wives

Tuesday, August 9  
Sightseeing Trip of City; Luncheon, Tour of Lilly Plant

Wednesday, August 10  
Facts and Fables about Imported Goods, Tea, L. S. Ayres Co.  
Starlight Musicals-"Kiss Me Kate" Compliments of Pitman-Moore Co.

Thursday, August 11  
Motor Caravan to Allison Division of General Motors Plant No. 3 to see "Powerama" and for Luncheon



FIRST SESSION OF THE SEVENTH TEACHERS' SEMINAR

SUNDAY, AUGUST 7

K. L. KAUFMAN, PRESIDING

I shall refrain from any attempt at a formal welcome. We have enough experts up here to welcome you and bring you greetings. I could not make any additions, even though my feelings are as sincere as theirs.

We know that you teachers are here because you expect to gain some profit from these sessions of the next several days, to profit in increased ability and increased capacity for better work. That is the basis on which these Seminars were set up by our Foundation.

We think that we have a good program for you. We hope you all participate in it fully. In that way you can get the most from it. I should like to tell you that we have evidence from our correspondence that before the week is out we may have the largest total registration of any of the single area seminars.

It is my pleasure to present to you first tonight the Chief Executive of our University. But before I do that, I want all of you to know that we regard him here as one of the best friends of pharmacy. He had a major part in merging our college with the University some 10 years ago. He set out to provide us with fine facilities and equipment and more teachers. He worked under great difficulties, but the most pleasant part of the whole thing is that to this date he seems not to have lost interest or faith in us. I think it is no secret to him that those of us in the Pharmacy College reciprocate that interest and that faith that he has shown in us.

He is a native of Kentucky. He has a baccalaureate degree from Kentucky Wesleyan and his Masters and his Ph. D. degrees in economics from the University of Chicago. In addition to some high school work, he taught at Earlham College, then came to Butler as the Dean of Business

Administration. In 1943 he became the President of this University. Since that time it has had its greatest growth, not only in physical aspects, but in many other ways, that it has experienced in its 100 years of existence. It is one of the few private Universities that has been able to do such things and still stay in the black. It is with a great deal of pleasure and honor that I present to you the one primarily responsible for these things, our President, Dr. M. O. Ross.

President Ross:

Dr. Andrew Cordier, formerly of Manchester College, Indiana, and now of the United Nations in New York City, told of a certain German observer from South Bavaria who was recently sent to New York. Shortly after his arrival, this man was asked to address a group of mixed nationalities. His friends, realizing that he could only speak German, were amazed and surprised to hear him begin his address as follows: Frauen und Herren, Mesdames e' Monsieurs, Delegates and--he hesitated, stopped. He simply could not think of the feminine of delegates. So he tried again: Frauen und Herren, Mesdames e' Monsieurs, Delegates and Delicatessens.

Now this evening, I have the privilege of saying not delegates and delicatessens, but Ladies and Gentlemen, it is a very great pleasure to greet you and to welcome you to the Butler University campus. It is a particular pleasure to have you here in this our centennial year.

As Dean Kaufman has indicated, our college of Pharmacy is one of our youngest departments. It also is one of our most progressive departments.

Ladies and Gentlemen, you have the privilege, as you fully know, of belonging to one of the most dynamic sciences, most dynamic professions and industries that there is in this country. During the past 20 years, you have brought one product into existence after another for the benefit, the welfare, and the health of mankind. From the sulfa drugs to the broad spectrum antibiotics down to two of your very latest products, tetracycline and the Salk vaccine, you have literally done miracles during the past several years.

Just a few days ago I read in one of your magazines the description of a new product, that is going to make the life of those on operating tables and in that very difficult post-operative period much easier than it has been in the

past. I understand that clinical examinations and tests of this product in hospitals and laboratories have resulted in its meeting some of the very best tests of an ideal anesthetic. To me, the most unique and interesting characteristic of all, was this statement. "It will make the patient much happier." Now that is indeed a miracle, Ladies and Gentlemen, for those of us who have gone through such serious experiences.

Think of the fact that the population of this country is growing at a truly amazing rate. Last year, as you know, we added some 2,800,000 people to our population. Just about 6 weeks ago we passed the 165,000,000 mark and now are well on our way to 170,000,000 people in this country. Think of the two most rapidly growing groups, the two most rapidly growing segments in our population--that group under 15 years of age and that group to which I now unhappily belong, that group over 55 years of age. It is these two groups that need your science. It is these two groups that need the many products that you are bringing out for man's welfare and man's health. You have conquered many diseases as the result of your research and your analysis.

There are many fields in front of you of course, cancer, hypertension, mental illness of all types, and not to neglect one of the most important of all, the common cold. These are fields that are challenging you. A challenge which I am sure you will meet as time passes.

We have found as you have found that your educational program is an expensive program. Ladies and Gentlemen, I as beginning to think that after some 13 years as a college president that there is no cheap educational program on the part of our colleges and universities at the present time. As a matter of fact, mounting costs are causing us all manner of problems, are causing us to search for all new means of raising money.

Not long ago, in fact just during the past semester, I attended an educational conference in another state. I suppose there were some 60 or 70 colleges represented and, as always, no matter what subject we started out discussing, we wound up discussing how we were going to finance all the things we wish to do in our various educational programs.

There was one representative, a Monsignor Gadden, representing the Catholic colleges of this segment of the country, a delightful Irishman with a wonderful wit. He told us this story illustrating the techniques to which

money raisers have come.

Two nuns, one older and wiser, a delightful lady, and the other a very naive and inexperienced young lady, but very enthusiastic, were asked to raise a certain fund for a certain church charity. They worked for an entire week without very great success. By early Friday afternoon, the older nun said to the younger, "Let's go out to the race track. The people out there are generous. We can probably raise more out there than we have raised elsewhere."

And so out they went. From the beginning of the first race at 1:00 to the beginning of the last race at about 5:00 they had raised about \$100. In that last race the older nun saw the name of a horse, Benedictus--a long shot, 40 to 1,--and unknown to the younger nun, she slipped up to the window and placed the entire \$100 on the nose of Benedictus to win. Guided by some kind providence, Benedictus came in. She was ashamed to take that piece of paper back to the window and cash it in, so she told the younger nun, "If you will take this piece of cardboard to the last window, you will find the man there the most generous person we have contacted all week. And so the young nun took this piece of paper up there and came back with her eyes shining and her hands filled with \$4,000.

"What did he say to you?"

"He didn't say a word to me, but he turned to the man in the booth with him and spoke to him in Latin."

"Well, what could he have said to him in Latin?"

"Jesus Marcus, Benedictus Rectus."

Now Ladies and Gentlemen, this illustrates the straits to which we are coming in raising money. We haven't yet resorted to this extreme, but who knows, sometime we may.

But in all seriousness, Ladies and Gentlemen, it is a very great pleasure to greet you and to welcome you to the Butler University campus. May I express the hope that you will find your visit here not only instructive, as I know you will, judging from the interesting program that you have arranged, but also pleasant and delightful.

Thank you, President Ross. Now I should like all of you to meet the First Lady of the University, Mrs. Ross. Will you take a bow please?

In case you do not already know him, I would like to present Dean Emeritus E. H. Niles.

The next speaker must be the type of individual that all college presidents dearly love to have around because he represents the organization which helps to finance this Seminar. I don't know whether the American Foundation for Pharmaceutical Education is making any bets at the \$2 window or not, but they certainly have helped us a great deal for which all of us in teaching are profoundly grateful.

For the benefit of some who may not know his background, I should like to state that Dr. Briggs has earned degrees from George Washington and from Maryland, and he has been honored by degrees from Philadelphia and Temple. He has held nearly all of the important positions which a person could hope to hold in the relatively short time that he has been around. To mention a few, he is Treasurer and member of the Board of Trustees of the United States Pharmacopocia, a member of The National Drug Trade Conference and is a former official of the Veterans' Administration. He has been a professor and dean, and currently is the Executive Director of the American Foundation for Pharmaceutical Education. It gives me a great deal of pleasure to present to you Dr. W. Paul Briggs.

Dr. Briggs:

Good evening my friends, it is good to be here.

I have never pretended to be very smart. But I do claim to know enough to quit while I'm winning. And if anyone expects me to undertake to make any address following the eloquent Dr. Ross and preceding these two elderly scholars on my right (who were my preceptors) you have made a gross mistake.

I would like to pay my deepest respects to Dean Emeritus Niles and to again be on this campus where I had the privilege of appearing at the time your splendid building was dedicated. We are glad that you are having this Seminar. I am particularly interested in the pharmacy one because it is my own field.

The Foundation is keenly interested in all of the work of the colleges and particularly the Seminar program. We consider the program to be highly productive and fully deserving of every possible contribution that the Foundation

can make. In the environment of Butler University, I know your sessions will be pleasant as well as profitable.

Thank you, Dr. Briggs. The next greetings are brought to you from a man who has the title of Assistant Dean.

This Gentleman, however, speaks to you as the President of the American Association of Colleges of Pharmacy. I think that those of you who are new at these Seminars should know that he has held a number of fellowships, that he has taught at Baylor University and that he has for some time been back with his alma mater at P. C. P. It is my pleasure to present to you Dr. L. F. Tice, President of the American Association of Colleges of Pharmacy.

Dean Tice:

Mr. Chairman, President Ross, and Seminarians.

I had hoped to have more of the officers of the AACP here tonight. I believe, unless I am mistaken, that there is only one other officer present at the moment and that is Dean Hewitt who is sitting in the front here and who is the President Elect of the AACP.

I want to speak very briefly this evening about the Teachers' Seminar because it is terribly important that we get off to a good start. These Seminars have been given now since 1949, and although I did not attend the first one held at the University of Wisconsin, which was also in the area of Pharmacy, I had reports from it from some of my colleagues who did attend. I have attended 3 or 4 of the Seminars since they began and in each instance I felt that a great deal was accomplished.

Frankly, the AACP should not and does not have as its function just that of being a social organization. Every officer and every member of the executive committee realizes that the American Association of Colleges of Pharmacy means nothing at all unless it improves pharmaceutical education. The very first way to improve it is to have us all be better teachers.

The Foundation has supported our program very generously. The truth is that since my good friend Paul Briggs has been the Director of the Foundation the amount of financial support which has come to the Association from this source has increased greatly. I wish I had the time to tell you of some of the projects which your Association now has under

way, and which have been made possible by Foundation support-- projects which run into several figures. One in particular we asked for will cost the Foundation about \$100,000. This is typical of what the Foundation has meant to our Association. I am not saying this because Dr. Briggs is here. Don't forget that he was a Dean before he became the Director of the Foundation. He is still one of us.

Now the reason that the Foundation supports our Teachers' Seminars is because they recognize, I think as most of us do, that the future of American pharmacy depends upon how well we the teachers of pharmacy do our job. The annual budget which I believe is about \$6,000 a year for this program is a very sound investment. I know it has Dr. Briggs' full indorsement and I know it has the indorsement of the Board of Directors of the Foundation. This past year it has been my pleasure to be a member of the Board of Directors of the Foundation. I want you to know that the pharmaceutical industrialists from whence comes our support are men whom you should know better. They have the real interest of pharmacy at heart. When the Board of Directors meets, you can be sure it meets with only one idea in mind--and that is how can it help pharmaceutical education more. They are helping us greatly. As I remember the budget figures, well over half, and I would judge close to 70% of the entire budget of our Association comes from the Foundation.

Now for just a moment let us see what attitude of mind all of us should have who are teachers. You can, by the manner in which you ask yourself a simple question, appraise your attitude. If you say these words, "How can I be a better teacher," with a certain inflection it sounds like you are perfectly complacent, in other words you feel you are doing the best job anyone could do so how could you learn to do it any better. If you have this attitude, this Seminar will be almost meaningless because your mind is closed before you start.

On the other hand if you will ask, "How can I be a better teacher," speaking it sincerely, with motivation, and with a full desire that you do want to do your job better, then this Seminar can do a lot for you. I well remember the soul-searching that I gave myself last year at the University of Connecticut. There, for the first time, some professional educators taught me a little about pedagogy because, like Topsy, I just grew. As a result of sitting there and listening to men who had made their life's work the business of teaching others how to teach,

the mechanics of teaching and the learning process, I was able to go back with an entirely new concept and to face my teaching duties with new enthusiasm and a new sense of dedication.

And that's what all of us should do who attend these Seminars. If you think for a moment that there is not a need for us all to improve, may I ask each one of you to ask yourself, "Is the profession of pharmacy all that it possibly could be? Are pharmacists doing the very best job they could do?" If this answer is a doubtful, "No it is not all that it might be," then let me tell you this: Is it not true that in our hands lies the future of the profession? Does not every future pharmacist pass through our hands before he goes out into practice? If this is the case, then have we as teachers over the past several decades done the job that needs to be done? I think that it is no secret, at least in our own circles, that we have not done the full job as it needs to be done. Oh, yes, we have turned out technicians, but there is something else that is required. We need to turn out pharmacists who have a full sense of their professional responsibilities. We need to turn out pharmacists who will not be guilty of some of the malpractices which we as pharmacists know exist today. When we do these things, then we can look back upon our performance with pride and with satisfaction.

It is my firm conviction that pharmaceutical education has come a long way, but we still have a long way to go. I know of no other type of activity which is likely to lead to better teaching, to better pharmacy, and to the better practice of pharmacy than these Teachers' Seminars.

So in closing and in bringing you the best wishes of the Association, may I leave this thought with you. Come into these meetings during this week with an open mind. Don't be so sure that the work that you are doing is being done the very best that it can be. Don't be so sure that you as a teacher are key-letter perfect. If you approach this Seminar this week with an open mind, I'm sure that each and every one of you will have the experience of recognizing on many fronts where you can improve the work that you are doing. That is the purpose of the Seminar. It is the reason the Foundation supports it and the reason the Executive Committee of your Association plans it and programs it each year.

Now we have a wonderful physical plant here. We have excellent facilities. I see no reason why this should not be a very progressive week and a week of great accomplishments.

Personally, I am very optimistic about the future of pharmacy. I have given well over 20 years of my life in teaching pharmacy. I love it. If any of you young fellows here have any lurking doubts as to whether you made a wise selection when you chose a career as a pharmacy teacher, let those doubts disappear from your mind. There is a tremendous challenge for us today because pharmacy is going through a great transition. But I ask you not to look back at what pharmacy has been. Keep looking ahead to what pharmacy is going to be because it is my firm conviction that we shall have a great and glorious future. So enjoy this week, but above all, keep your minds open. I'm sure you will find new avenues of approach, a new understanding of the student, and a new knowledge of how to teach. These are the reasons for these Seminars. Thank you.

Thank you, Dr. Tice. With all of these references to the President Elect, I think it is only right that we make sure everyone knows who he is. Take a bow, Dean Hewitt.

Our final speaker tonight is the pride of LaJunta, Colorado. He has taken his degree work through the Ph. D. at the University of Colorado, has taught there, at Buffalo, and at Temple where he is now the Dean. Most recently you probably read that he added to his other laurels a fine plaque known as the Balen Award for his achievements on behalf of pharmacy. Dean Sprowls' job tonight is to serve as a keynote speaker to set the theme for the week. I know you will be anxious to hear what he has to say. It gives me a great deal of pleasure to present Joe Sprowls.

Dean Sprowls:

Thank you, Dean Kaufman. President Ross, my other friends on the panel, and all the members of this Pharmacy Teachers' Seminar: In addition to welcoming you on behalf of the committee, it shall be my purpose to outline for you some of the objectives and the basic plan for the Seminar.

The purpose for all Pharmacy Seminars was established by Drs. Elliott and Blauch in the report of the Pharmaceutical Survey in these terms: "The purpose ... is that of providing needed opportunity for the members of the teaching staffs and for graduate students to come into fruitful contact and to keep pace with progressive content and methods of

pharmaceutical education." It is a credit to the wisdom of these men that little can be added to this statement of purpose after six years of experience. In each of the Seminars the methods used have been altered to some degree and the field of study has been varied, but the objective has remained the same.

There is much work to be accomplished this year. In the approximately twenty years during which I have been engaged in the teaching of pharmacy there has never been a period during which I could complain because of a lack of challenge. Neither has there been a period during which the challenge was as great as that which faces the teachers of pharmacy today. The pressure of tremendous change which has taken place all about us has had its effect upon our curriculum and our teaching methods. The Pharmaceutical Survey brought into sharp focus the inadequacies of bygone methods and has encouraged us to bring into being new courses and new methods for meeting our teaching responsibility. We now find ourselves in a transition period during which the old is merging with the new and a different pattern of teaching is beginning to emerge for pharmacy.

For some of us the five-year program of education is an accomplished fact, for others of us it lies in the immediate future. (Perhaps when this group of pharmacy teachers convenes for another Seminar the five-year program will have been in effect long enough that our problems will be somewhat more common than they are at this moment). Some of us are now teaching in a six-year program of pharmaceutical education; for others, it is on the horizon. We are, therefore, not only faced with the challenge of change, but we are faced with the challenge of change within a pattern which contains little conformity.

Yet, from all of this will come a new and better curriculum for pharmacy. Much of the spade work has been accomplished for us--by the Pharmaceutical Survey which has established the objectives and by the Committee on Curriculum of the American Association of Colleges of Pharmacy which has established a proposed pattern. A glance at the printed program for this Seminar will quickly reveal to you that it was patterned after the recommendations of the Committee on Curriculum. The sequence of courses to be discussed and the course titles have been taken directly from the most recent recommendations of the committee. We realize that in many instances the course titles will be different from those which appear in the bulletin of your college. It may well be that no school offers all of the courses listed and in

the sequence in which they will be discussed, but this appeared to the Committee as the best common ground upon which to begin our conversations.

In part, the discussions presented in this program will be of an anticipatory nature because in some instances the majority of schools do not seem to be presenting at the undergraduate level course work which has been recommended by the Committee on Curriculum. Your Seminar Committee makes no apology for the inclusion of such topics. Certainly much of the flavor would be gone from the meeting and the program would lose much of its spice if we did not deal with anticipated course material as well as that which is already well established. In this regard let me say that all faculty members were selected on the basis of actual teaching experience with the course under discussion. In the language of the sports world, there are no "ringers" on this faculty; they are all persons who speak with authority.

Pharmacy is very fortunate in having a large number of competently-trained and forceful individuals who may be called upon to serve on such occasions as this. The greatest problem is not "who can we find to do the task?" but "whom shall we select for the task?" There was some feeling among the committee that new faculty members should be brought into the picture as often as possible in order that we may have the benefit over a period of several Seminars of hearing the views of many rather than a few. This suggestion and this alone accounts for any changes which have been made since the faculty of the first Pharmacy Teachers' Seminar. We feel certain that no one will take exception to this decision on the part of the committee.

Two special directives I must give you on behalf of the committee. First, we request that discussions be directed as much as possible toward the question of how to teach, and not what to teach. The primary objective of the Seminar is to improve teaching methods. We realize that it is often impossible to divorce method from content; therefore, we anticipate that some of the latter will be included. On the other hand, past experience has indicated that discussions regarding course content tend to become very long and controversial with the result that the primary objective may be lost sight of.

The second directive which I should like to leave with you is a request that in so far as possible the discussions be "student-centered." Too often our discourse reflects a consideration of what is most expedient or most practical

from the viewpoint of the teacher without primary consideration of the needs of the student. But all of us who have been teachers for any length of time realize that the learning process takes place entirely in the mind of the student. As teachers our principal task is that of training young minds. Professor S. Lawrence Bigelow once remarked that we devote much time and care to learning how to use balances, thermometers, refractometers, polariscopes and a whole multitude of other instruments, but we should do well if we devoted more time to learning how to use the most important instrument of all, the mind. This is good advice and we should make use of it. In addition to presenting facts and developing skills in our students, we must also be developing their reasoning powers as well as inspiring them to become creative and productive in their own right. Experienced teachers will admit that these are the most difficult tasks of all, albeit the most important.

Let us, then, keep the following questions in mind as we conduct our discussions: How can we make our factual material most understandable for the student--and most readily assimilated--and most useful? How can we best develop and perfect the skills which we expect him to possess at the time of graduation? How can we inspire him to think and to reason and perhaps to invent new ideas for himself regarding the facts and theories which we are presenting? This is a Seminar for teachers. But it is a Seminar for teachers of students. Therefore, it is not inconsistent to request that this Seminar be a student-centered consideration of the problems confronting the teachers of pharmacy.

This is a brief statement of the objectives and plan of the Seminar. But it is easy to make plans; the difficulty comes in fulfillment. Your assistance will be needed if this program is to be a success. Again using the parlance of sports, we have not designed this Seminar as a "spectator activity." We invite each of you to make yourselves a part of the program--to make your ideas known if and when they are timely. We urge the younger members of our group particularly to ask questions freely, because they are all the ones who should benefit the most in years to come from this experience.

I call your attention to the extensive amount of time which has been provided for discussion sessions. The committee felt that this was a mandate as a result of the great success enjoyed by the Pharmacy Teachers' segment of the Connecticut Seminar of 1954. The round table discussions were the highlight of that program, and they will be repeated here.

This year's discussion sessions have been planned as work-shop groups. Each afternoon the whole group will be divided into smaller segments with a common interest and will attempt to apply the morning's presentation to their area of instruction. The whole body will then be given a summary of the discussions of the various workshops. We request that formal presentations be kept to a minimum during these workshop sessions and that informality may prevail.

All the elements have been assembled here at this fine host institution for a stimulating, profitable and thoroughly enjoyable five days and we of the committee urge you to make the most of the opportunity which has been presented.

## MORNING PAPERS

MONDAY, AUGUST 8

DEAN L. F. TICE, PRESIDENT AACP, PRESIDING

## Fundamental Learning Concepts

Roger W. Coulson

Butler University

In order to think about fundamental learning concepts it is probably appropriate first to define learning. An adequate definition, although not necessarily complete, states that learning is a process whereby behavior is changed as a result of experience.

In this definition there are four key words or concepts: process, behavior, change, and experience. First, learning is a process, that is, it is not a state of being, a condition, or a simple reaction to perceived stimuli, but is a dynamic thing, something which is going on. Second, in order for learning to take place there must be behavior, which again is an ongoing, active thing. Third, not only must there be behavior, but this behavior is changed through the process called learning. This change in behavior may, in fact, be evidence of the fact that learning has taken place.\* Fourth, learning is directly dependent upon experience: experience precedes and accompanies learning, and learning is

---

\* It should be noted that the direction of change is not indicated by the definition: that is, in the classroom wrong (or undesirable) change, as well as desirable change, may result from the learning situation provided. In teaching, the direction of desired change is determined in advance. But according to the definition of learning, the change can be in any direction. It is one of the jobs of the teacher to encourage these changes to be in the desired direction.

itself an experience. It should be noted, too, that experience may be either overt (as in the case of swinging a ball bat) or covert (as in thinking), and it may be first hand (ball bat) or vicarious (reading).

Before continuing further, let us consider two limiting considerations with reference to this definition of learning: (1) there are means other than learning which may result in changed behavior--drugs, accident, surgery, and the like--which do not qualify as being learning experiences; (2) there are also other processes of which humans partake--the processes of reproduction, digestion, and the like--and learning is not at all times the most important process with which a person can be occupied.

From the foregoing and from common experience it may be seen that learning doesn't exist as a thing by itself. It may be appropriate to ask, then, "Where does learning take place?" Perhaps this is an elementary question, but nevertheless a rather crucial one. The fairly evident answer to our question is, "Learning takes place in a learner." That is, inanimate objects are not seen in this context as being capable of learning.

To help us understand a learner, it might be appropriate for us to attempt to build a model of a learner. If we can successfully construct a model, we might more easily see and hence perhaps understand what the learning process is and how to encourage learning in a learner.

In order to build a model we need first to be able to recognize a learner. What, we may ask, are the unique characteristics of a learner? There may be four or five of these characteristics.

(1) From the definition it can be seen that it must be capable of behavior. This requirement may be presumed to be met through using a wooden platform on which are mounted some wheels. Thus the movement of the platform is the behavior which was required.

(2) Implicit in the definition, too, is the fact that the behavior of which our learner is capable must be alterable. Now, in order for the behavior to be alterable, two conditions must be met: (a) the behavior of which the learner is capable must be varied--our platform must be capable of going in directions other than just one, and (b) there must be something which will serve as the means whereby the change

can be effected. Some mechanism which can be connected to the wheels of the platform may be mounted on it and appropriately connected up in order to satisfy this latter condition. In order to satisfy the definition, too, this mechanism should itself be in action--the gear box of a clock would probably satisfy this requirement in our model.

(3) Something must be present which will serve as a stimulus to causing the change. A flashlight might be used as an external source of energy in accompaniment with our model. If the model learner can respond to this stimulus, learning might result.

(4) In order for the stimulus to be utilized, it must be received. A photo-electric cell, since it is sensitive to light, may, if adequately wired to the existing model, satisfy this requirement.

(5) Finally, our model must be capable of being repaired when and if something goes wrong. It must either be simple enough to be repaired, or, not being simple, it must be well understood. Oil, pliers, and the like, as well as a repairable structure--whether or not fully understood--might satisfy this requirement.

Now, what are the fundamental learning concepts illustrated by our model?

First, learning requires an organism. Perhaps you have taken this fact for granted. Nevertheless, there must be an organism, that is, by implication, there must be a nervous system, including receptors--both internal and external. This nervous system is the means whereby learning takes place. It in turn stimulates the other parts of the organism to make responses. This nervous system is the characteristic which distinguishes the learner from inanimate objects.

Next, learning involves activity. That is, the nervous system must be in operation in order for learning to take place. This does not mean gross physical activity, for, as you know, activity may be either gross physical (overt) activity or unseen mental (covert) activity. But whether overt or covert, that activity depends on the nervous system's being in good repair and on its functioning or being in operation. As a parallel, a tape recorder is in operation before recording is possible.

Third, some stimulus must be present in order for learning to occur: just being alive (or, better, just

existing) is insufficient as a condition for learning. The stimulus may, however, be either external or internal. In many cases of learning, the stimuli actually do emanate from inside in the form of memories, attitudes, habits, and the like, which may be utilized in learning. But not all stimuli serve as stimuli to learning. Therefore the stimuli must be perceived or at least must be accepted by the organism within the learning framework.

These, then, are the bare essentials. But this isn't enough to explain the learning that takes place or doesn't take place in our classrooms. There are many conditions which may affect the chances that learning will occur. It is probably here that our major interests lie.

First, let us approach the matter negatively. What may interfere with learning? Among these factors are inadequate or inappropriate previous learnings, low intellectual level, and the like, which might be compared to poor wiring or the use of poor materials in constructing our model. Although intellectual level probably can be affected somewhat by environmental stimuli, etc., in the school our preference is to spend the majority of time in remediation and in encouraging desirable learnings in the initial contact. Screening of candidates on valid bases and under the most favorable conditions probably forestalls many effects of low ability in the professional schools.

If our model is not well maintained, he will learn less well than if he is well maintained. In order for maximum desirable learning to take place, the organism must be adequately fed, etc.

If the model experiences a temporary short circuit in his wiring, he will respond inappropriately. The learner who is seriously emotionally upset over a period of time may react unfavorably to the learning situation. Adequate counseling services are a prime necessity in centers of learning. The addition of a few drops of oil can sometimes save the whole machine.

A bad photo-electric cell may result in wrong perception (interpretation) of stimuli. In a learner wrong perception may result from faulty equipment (eyes, ears, etc.), faulty use of equipment, inadequate previous learnings, unstimulating environment, etc. In the classroom the learner is disadvantaged when he misunderstands what is said or when what is being studied lacks meaning for him because his experiences do not include previous contact with the framework of the new

learnings. Background meanings can be taught as well as can any other new learnings. (The student whose response to the question, "What is the most important fact about nitrates?" is, "They are cheaper than day rates," may be reflecting deficient background experiences.)

If the model does not continue to operate in accordance with his new learnings, he may develop rust on some of his gears. Then when he is called on to use his new learnings the situation will be a difficult one. Forgetting may result from disuse, as well as from the operation of other factors. What is learned must be put to use if it is to be retained. It is not enough, however, to assume that a learner will know how to use new information. The use itself must be taught, as well as the ability to identify the situations in which it is appropriate to use the new information or skill. The knowledge of how to use new information is itself new information which sometimes must be taught.

Finally (though there are other possible interferences with learning), each learner comes with certain needs built in. In order for him to operate most efficiently as a learner, these needs must be satisfied. At this point a distinction should be made between needs and wants, and a recognition should exist with reference to the fact that a situation in which a need is temporarily unmet does not define a frustrating situation. But learning efficiency is, from this point of view, probably lowered to the extent that genuine needs are unidentified and unmet.

Having considered briefly some possible interferences with learning, we may ask whether there are some conditions which may actually enhance an organism's chances for learning.

Certainly a student with intent to learn has an advantage over one whose intent is to avoid learning or who lacks intent in either direction.

The emotional tone or climate of the classroom may also be utilized to encourage learning. A classroom should be a place to make mistakes as well as or in addition to being a place where mistakes are avoided. A mistake made under supervision may provide a better learning situation than avoidance of any mistakes at all costs, especially since the costs are not infrequently too dear and since we may consider that one desirable learning for students to master is the matter of profiting from error. At the same time, there are always limits to freedom. Just the same as your freedom ends where my nose begins, so a fatal accident in a laboratory

does not define a good learning situation for the deceased.

Motivation is universal. All active organisms are motivated organisms. But when the motivation to engage in the activity of learning is made stronger than the motivation to act in other directions, the learning which results may be presumed to possess greater potency. Two other points with regard to motivation: First, motivation is often considered to be either external or internal, but from another point of view, unless the external factors are internalized, the individual is not truly motivated. Second, the teacher cannot really motivate his learners, he can only set up an environmental situation which the student can internalize if he will. But in setting up this situation the teacher will utilize all he knows about the nature of the learner, of teacher-learner interrelationships, and of the psychological nature of his subject matter--how it relates to the learner as a human being as well as a learner.

Just as a lack of meaning may interfere with learning, so the injection of meaning into subject matter may enhance learning. A guide who sees relationships in advance of their occurring to the learner and who possesses the ability to point out those relationships will probably encourage learning's taking place, for "meaning" means "in relation to."

Learning is made more permanent when it is reinforced through repetition in a variety of situations. Mere repetition is insufficient except in some very unusual situations in which only rote memory is required. Even in cases of rote memory, however, in situations wherein meaning is injected, the rotely remembered objects are better understood!

It is also desirable that the material to be learned in a formal learning situation be at the maturity level and the interest level of the learner. The person or persons guiding the learning probably have well in mind the desired sequence of study and in addition are able to show relationships which may stimulate the interest of the learner. However, interests may fluctuate, and hence the learner may not sustain an interest in a subject matter area which once captivated him. In addition, the fact that a student may be "interested" in becoming a pharmacist is no guarantee that the course of study which has been designed to lead to graduation and licensing will hold interest for him. In the same manner, the fact that a student is strongly interested in one area does not mean that that interest will necessarily transfer to another area of study. Interests are or may be very specific rather than generalized. It is probably not

sufficient to rely on a student's interests, but rather it is probably necessary to stimulate interest at all times.

Of these desirable attendant conditions which I have chosen to mention, the last states that the learner who has learned how to learn has the advantage over the one who does not have this skill. But this skill is a specialized skill rather than a generalized skill since learning is specific to the task. That is, a "good learner" in the elementary grades may not be a "good learner" in college since the level of difficulty of relationships is more advanced in college than in elementary school. Similarly, a "good learner" in literature may not be a "good learner" in chemistry since the analytical skills are not identical. Also, a student is probably only rarely a "good learner" in all courses in pharmacy since each identifiable subject matter area is, to the extent that it is identifiable from other areas, different in the demands of the student. If this were not so, Dr. Oppenheimer should recently have succeeded Albert Einstein as our best political thinker.

In summary, then, we may say that the following comprise the nature of the learner: his structure--receptors, nervous system, physiology other than the nervous system, etc.; his manner of functioning--how he characteristically perceives stimuli, his skill with tools and materials; the effect of his past experiences and the learnings which resulted from them--expressed as habits, emotions, attitudes, academic learnings, etc.; and his needs however classified. Concerning needs, at least four statements may be appropriate: (1) needs vary in strength from time to time, (2) needs characteristically occur in combination rather than singly, (3) needs (as distinguished from wants) must be met in order for the organism to maintain its integrity, and (4) the individual's actions are always in accord with his needs, but his needs are not always rationally recognized by or known to the individual.

We may also say in summary that the following elements are included in the nature of the learning situation: the environment of things--laboratory equipment, audio-visual aids, texts, and the like; and the interpersonal environment--teacher-pupil relationships, pupil-pupil relationships, pupil-administration relationships; and the like. These elements may greatly aid or seriously hinder the learning done by the student. In this area attitudes may readily generalize or transfer, as in the case of the student who comes to dislike a given course because he disliked the instructor intensely.

Although this discussion has been more suggestive than exhaustive, perhaps one additional suggestion may be made in conclusion: You can't keep the learner from learning! The problem of the teacher is to help the learning done by the learner to approximate the ends described by the course of study.

Discussion:

It was asked whether there was any information concerning how long we remember things learned by trial and error as compared to learning by motivation. The reply indicated that there were no data available.

The problem of transfer of learning from one course to another was mentioned. It was stated that transfer must be taught as transfer; that it is not sufficient to say that "this is a general principle which you will apply later on." One must say "here is the principle, here is the application. These are the things to look for when you apply this general principle."

Fundamental Teaching Concepts

R. R. Armacost

Purdue University

(Read by Paul Klinge, Biologist,  
Howe High School, Indianapolis)

I can't teach you to teach. If I had this ability I, too, would be a better teacher. But I do think I can give you a prescription for good teaching. The effectiveness of this prescription, like that of any prescription, depends on the physiological and psychological state of the patient. For one thing he must not be allergic to teaching suggestions. As you well know, allergies frequently make it impossible to prescribe certain ingredients. I hope none of you leave after this speech with the hives or even an antagonistic itch.

The patient must also desire to have the ingredients work. He must want to become a good teacher because he believes good teaching is important. If he has the incurable disease, antiteachingitis, no prescription can help. In case you are not familiar with this malady, let me remind you

that there are many symptoms.

Diagnosis is usually made from such evidence as: lack of interest in students; a general lack of enthusiasm in the classroom and laboratory; and above all the firm conviction on the part of the diseased that the subject matter involved is such "good stuff" that students should want to learn it regardless of how it is presented. A secondary infection usually follows which is characterized by verbal flogging of the class for lack of interest, poor test results, and poor attendance.

"How shall we teach what we teach?" asks Dr. Samuel Meyer, Head of the Department of Botany, Florida State University, in a paper which I shall give you after this meeting. He points out that there is no one best method, but all methods have their elements of strength and their elements of weakness. He says, "Different people teach most effectively by different methods. No one method need be used to the exclusion of the others, and no one is better than the others. The best teaching undoubtedly results from a combination of clearly defined objectives, carefully selected materials, and the method best suited to the teacher's own talents." I hope you will read Dr. Meyer's paper carefully, and profit by the many fine suggestions given for the lecture, the discussion, and in my opinion, the most important method of all--the discovery.

Any phase of any subject can be divided into: introduction, assimilation; organization; conclusions; and evaluation. Before trying to teach, the instructor first chooses an area in his subject because it fulfills certain objectives of his course. In introducing it, he should develop interest and at the same time give a "birds eye" view of what is coming. Too many areas start with such statements as: "Today we are going to discuss etc. etc."

I once had a graduate student who wondered how to start the day's lecture on stimulus-response. I told him to start it with a bang-- but even I was startled when he set off a firecracker in the front of the room. You don't always have to start your teaching with a major explosion, but it helps. I don't think most teachers spend enough time organizing their thinking on how to begin. Many times the class is lost in the first few minutes of the hour--never to be regained.

Assimilation simply involves activities students have had or are assigned which help them in their study of an area. Experiences outside of class, experimentation and field trips,

reading, visual aids--all are important in getting a student ready to organize and discuss what he is supposed to be learning. The problem here is that so many instructors never seem to know what or even if their students have assimilated the desired material; organization is the art of molding together ideas, by discussion and questions, so that conclusions can be reached. My suggestion here is to get students to argue a little. Too often we get an answer, shake a head affirmatively, and go on; or we give students all the answers. Evaluation is simply what it implies--placing values on significant and diagnostic activities in the course.

By now I suspect some of you are shaking your heads negatively and saying "It won't work, my classes are too large." In classes over 35, you'll have trouble with discussion and organization. But even if you have to lecture all the time (which I doubt) you can introduce the subject in an interesting manner, plan varied activities for assimilation, and evaluate in terms of your major purposes.

At Purdue University, we have a graduate seminar in the Department of Biological Sciences, designed to help our graduate students become better teachers. This is one of the most interesting seminars I have ever had the pleasure of developing. The outline of the program is attached. We must select from this material, because we never have time to cover it all in one term. We have some good discussions, summaries of which frequently go back to our staff members in the various areas. It is the only seminar I've ever been in where faculty guests show up without being trapped and dragged in. Some come, I think, in self defense; others come out of curiosity. But the spirit is good and we're all trying to improve teaching. Some of our summary sheets are also included in this paper. There are many specific suggestions for good teaching, and I would like to emphasize a few of those listed.

No, I can't teach you to teach. But perhaps you may be able to help improve yourself and others by using the prescription offered here today.

I would like to take this opportunity to thank the American Association of Colleges of Pharmacy for inviting me here. You deserve congratulations for recognizing the importance of teaching in your field. I am sure that improved teaching will result in better trained pharmacists and an even more respected pharmacy profession.

THE TEACHING OF THE BIOLOGICAL SCIENCES IN COLLEGES AND  
UNIVERSITIES

<u>Supplements</u>	<u>Course Outline</u>	<u>Representative Assignments</u>
I. Some reasons for including the biological sciences in a modern college or university program.	The biological sciences as a part of general education.	1. List major objectives of your University
	The departmental biological sciences.	2. List major objectives of your department
II. Basic courses and sequences in the biological sciences.		
III. Selecting and organizing the content of courses in the biological sciences.	Developing a course  Planning for a class or laboratory period.  Teaching methods: lecture; lecture-discussion; lecture-demonstration; laboratory, field trips and other community resources; reading-discussion; assignments.	3. How would you proceed in the development of a general education course in biology?  4. Analyze "a successful class."  5. Develop a written plan for a class or laboratory.  6. Compile criteria for choosing a text.  7. Theory and practice in the use of audio-visual aids.  8. Test item construction.  9. What things should be considered in computing a final grade?  10. Replan a classroom.
IV. How to choose a text. The textbook and reference book systems.		
V. The use of audio-visual aids.		
VI. Evaluating and recording student progress		
VII. Classrooms and equipment.		
VIII. The library		
IX. Suggestions for pursuing a research problem.		

- X. Professional growth: organizations and publications; teaching load; basic responsibilities.
- XI. Relationships with: other teachers; students; administration.
- XII. Some suggestions when applying for a position.
- 11. Write and criticize letters of application.

#### Some Suggestions for the Improvement of Classroom Teaching

- I. Respect the intelligence of your students.
  - A. The instructor should not set himself up as an infallible authority.
  - B. Interruptions for the sake of clarity and comprehension should be encouraged.
- II. Attitude of the Instructor
  - A. The general attitude of an instructor should be one of helpfulness.
  - B. The instructor should strive to have the students have a feeling of trust in him.
- III. Presentation of material.
  - A. Presentation should vary, and personality of instructor should be given consideration.
  - B. At all times, the instructor should be concerned with the maintenance of student attention.
  - C. The instructor should try to be natural as contrasted to aloofness.
  - D. The instructor should try to develop an interesting manner of presentation.
  - E. Material should be presented in a logical, planned way (at least show some reasoning of development by the instructor).
  - F. An instructor should show enthusiasm.
  - G. If an instructor uses notes, blackboard, or the like, he should still maintain eye and/or verbal contact with his students.
  - H. Informality, within reason, relaxes the students and can help improve learning.

- I. An instructor can help a student by recognizing and relating information from one course to information in another course.
- J. In small, homogeneous classes of students, particularly in advanced courses, project work and student sponsored discussions can be valuable.

IV. Audio-visual Aids.

- A. A blackboard, properly used, is a helpful visual aid.
- B. Mimeographed material can supplement text and reference material and serve as notes in parts of a course.
- C. Other types of audio-visual aids are useful when they do not replace living material or first hand studies, but are used because the above are not available.

Some Suggestions for the Improvement  
of Laboratory Teaching

- I. Proper Directions
  - A. Give a clear, concise explanation of laboratory procedure. Avoid giving long speeches.
  - B. Carefully explain techniques to be used for the first time and point out errors commonly made in a given type of laboratory work.
  - C. Demonstrate laboratory procedure, whenever possible.
- II. Respect a student's effort, and encourage him to ask questions during the laboratory period.
- III. Conducting the laboratory.
  - A. Develop a spirit of informality, but under no circumstances permit any "horsing around".
  - B. Plan for an adequate core of material to be studied, but don't try to cover too much.
  - C. Discuss laboratory work with individual students from time to time.
- IV. Equipment.
  - A. Have enough equipment for each student, if possible. Group use of equipment is not usually recommended.
  - B. Check equipment before laboratory time.
  - C. Be sure you know how to operate or use equipment.
  - D. Don't overuse student in preparation and cleaning up of laboratory.

## V. Demonstrations

- A. Be sure they work.
- B. Don't fake results.
- C. Explain each step of demonstration.
- D. Discuss results.
- E. Plan so that ample time is available and demonstration is not going on at the sound of the bell ending the period.

Seminar in the Teaching of the Biological Sciences  
in Colleges and Universities

A general technique for construction of so-called instruments of evaluation is suggested by R. W. Tyler:

1. Statement by the teacher of his objectives.
2. Description of the kinds of student behavior that indicates growth toward achievement of these objectives.
3. Invention of methods of observing and recording the behavior that indicates progress toward achievement of objectives.

The first two steps depend primarily on the teacher of a given course. Step 2 is difficult to do. In step 3, the technician or professionally trained evaluator can help. It is quite clear that written examinations, whether essay or objective are not adequate for obtaining all the evidence or the entire basis on which evaluation should be made.

Some suggestions of activities which might be considered as things on which to place values are:

1. Examinations: minor quizzes, major tests
2. Recitation: discussions, daily or weekly assignments (written)
3. Laboratory: laboratory exercises including notebooks, laboratory workbook material, field trips, write-ups and activity.
4. Supplementary: projects, reports
5. Attitude: effort, attendance, improvement, class conduct.

Evaluation should help:

1. Prescribe remedial procedures to correct specific weaknesses on the part of a class or an individual.

2. Compare the efficiency of various teaching procedures; difficulty of different areas of subject matter.
3. A student to realize how well or poorly he is doing in a course.

### Some Suggestions to Consider in Writing Test Items

#### General

- Keep objectives in mind.
- Carefully work out clear directions.
- Use understandable language.
- Use different types of test items.
- Consider what a given type of item measures.
- Answer to one item should not give away answer to others.
- Consider which type of item measures what best.

#### Specific types of Items

##### True-false

1. Avoid ambiguous statements.
2. Be careful in the use of such words as: all, never, always.
3. Keep items short.
4. Determine a fair way of scoring.

##### Completion

1. Place all blanks to the left to facilitate scoring.
2. Number blanks.
3. Provide adequate space for the answer, one word per blank.
4. Avoid too many blanks per sentence.
5. Question should have a definite answer, but give credit for synonyms, etc.
5. Write in a manner which will lead to the answer desired, rather than some other answer.

##### Multiple choice

1. Have four or five choices.
2. Take care in selection of "decoys".
3. Have one correct choice.
4. Develop a consistent form.

##### Matching

1. Have five to eight, closely related phrases, words, or statements to match.
2. Place two or three more choices on one side than one on the other.

3. Consider and allow for the amount of time required to complete this type of item.

Picture-diagram

1. Make pictures or diagrams clear and large enough.
2. Make arrows, lines, etc. which point to parts to be labeled, connected, etc.--very specific.

Essay

1. Limit length of answer.
2. Avoid general requests.

Teaching Biology by a Combination of Methods

Or  
Biology Teaching in "Three-D"

Samuel L. Meyer

Florida State University  
(Presented as a supplement to preceding paper)

How shall we teach what we teach? It is not my purpose here to enter into any of the time-worn controversies concerning the relative merits of lectures versus discussions or laboratories versus demonstrations. We will probably all agree that there is no one best method of teaching. All methods have their elements of strength and their elements of weakness. We will probably all agree that different people teach most effectively by different methods. The best teaching undoubtedly results from a combination of clearly defined objectives, carefully selected materials, and the method best suited to the teacher's own talents. However, it is my opinion that we sometimes get in a rut as far as teaching is concerned. We may almost become fanatically prejudiced in favor of one method as opposed to another. Such short-sightedness may blind us to the sources of strength that may be added to our teaching effectiveness through a combination of methods. It is my purpose here to call your attention to the contribution which can be made to effective teaching through utilization of combined resources.

It is not always easy to find the proper terminology to be used in differentiating one method from another. In fact, there is no little confusion in such terminology. In this presentation, I shall refer to the "three-D's" in biology teaching: discourse, discussion, and discovery. From these approaches to our science, we have tried to create a pattern of teaching which will impart to the student both information

and inspiration. Let us now consider each in some detail.

1. The discourse. This is obviously the use of the lecture method, a technique which, for some reason or another and in some quarters, has fallen into disrepute. The great majority of college teachers use it but few use it effectively. One of my former colleagues once described the lecture method as "wiring a textbook to sound." Another biologist has termed it a situation during which "the notes of the professor become the notes of the student without going through the mind of either." A brochure of a liberal arts college which emphasizes the conference plan of instruction refers to it as "the pouring of knowledge into a passive receptacle."

In spite of its weaknesses, in spite of the training in addition to knowledge of subject matter it requires, it is my sincere belief that the lecture method can provide thrilling experiences both for students and teacher unmatched by any other technique. There are few teachers who are masters of the lecture method. One was Dr. E. E. Reinke who, for many years before his death, was Head of the Biology Department at Vanderbilt University. Many students at Vanderbilt took General Biology not because they were particularly interested in the contribution that subject might make to their education, but because they felt that a degree from Vanderbilt would have lost something of its significance if they graduated without having had "Dr. Reinke's course." It was an exciting experience for me as a young instructor to sit in the back of the lecture hall and watch the master teacher work. By the forcefulness of his personality, the logic of his organization, the originality of his ideas, the enthusiasm of his presentation he would make the facts of biology meaningful, he would light the fires of intellectual curiosity in the minds of the young people whose lives he touched. True it is that few men can lecture as E. E. Reinke could. My present concern is that, for some reason, we are not creating in young graduate students the desire to achieve such perfection.

A lecture need not be a dull and uninteresting recitation of dead facts. It can be a living vital thing, a picture, a poem, a song. It can reveal in the impressive and inspiring fashion that only the spoken word can convey the fascinating story of embryonic development; the intricate structure of plants and animals; the marvels of adaptation; the significance of photosynthesis; the mystery of the origin of life; the explanation of inheritance; the contributions of biology to human welfare; the hopes, the successes and the failures of the pioneers in the inspiring history of our science. The discourse, the lecture method has much to recommend it as an effective teaching tool.

2. The discussion. Here we shall consider teaching by the method usually described by the term "discussion" or what S. M. Dietz has called the "group-conference system." According to Dietz this technique "makes it possible for the student to think in the subject using information and results accumulated individually and in groups." At Florida State University during any period or part of a period when we use the discussion method, all students study the same materials, perform the same experiments, observe the same demonstrations, solve the same problems. However, the topics discussed between individual students, between groups of students, between individual students and the teacher, and between groups of students and the teacher may vary considerably. The student finds himself in an atmosphere of freedom and informality and, at the same time, in a learning situation which makes rigorous demands of his abilities. He must observe; he must describe; he must interpret; he must criticize; he must organize; he must defend. The teacher, on the other hand, finds the situation one that is exacting in its requirements of training, experience, and personality. It is his responsibility to develop the proper "atmosphere" in the classroom. There is no limit to the variety of questions that will come his way, the problems he will be called upon to solve, the differences of opinion he must resolve. Yet, he must never lose sight of the trend of thought, the theme, the objective for the day. He must know how to balance the discussion; how to encourage the shy and the backward; how to control the aggressive and the talkative; just the right moment to call on the right student for the right answer; how to project himself into a discussion or, and this is even more difficult, how to withdraw himself from it.

Bower Aly has pointed out several things that a discussion is NOT. He says, "Modern classroom discussion is not a dialogue between two or three bright pupils on the front row. It is not a question hour in which students ask a few questions and the teacher gives forth elaborated answers. It is not a period in which a teacher condescends to the group."

On the other hand, Aly states that "To be successful with the discussion method, the teacher must assume the role of learner along with his students. He must cast off the garments of infallibility and appear as one of a group seeking knowledge of a subject which commands interest and even admiration." Jacques Barzun observes that "Handling a discussion group requires special talent." He compares the role of the discussion leader to "that of an orchestra conductor except that neither he nor the members of his orchestra have a score before them. Yet the result of the evening's noise must be as

intelligible as a symphony." Cardinal Newman emphasizes the strength of the discussion method when he says, "No book can convey the special spirit and delicate peculiarities of its subject with that rapidity and certainty which attend on the sympathy of mind with mind, through the eyes, the look, the accent, and the manner in casual expressions thrown off at the moment, and the unstudied terms of familiar conversation." In the presentation of many kinds of material, the discussion method can be used with great effectiveness.

3. Discovery. In this the third-D of the group, we include a variety of experiences with emphasis on the material itself. Through his own efforts the student discovers information and sources of information. This discovery may be facilitated by observations under the microscope, a dissection, a field trip, a movie, a lantern slide, a chart, a map, a model, an experiment, a demonstration, a reference in a book, an original research paper. W. Hugh Stickler refers to the conflict between the relative merits of the "demonstration" versus the "laboratory". It is his opinion that much of the so-called "controversy" lies in the definition of terms. In that he is certainly correct. It is impossible to teach biology by talking about it. The experience to be remembered by the student is that which results from contact with the material itself. One of the advantages enjoyed by the biology teacher is that his subject matter is alive. For that reason, whenever possible, we strongly recommend use of living material in the classroom or in the field. Sometimes, however, the most fruitful observations cannot be made on living things. A phase in a life history, a stage in development, a structure may best be revealed through the use of preserved or fixed and stained material. Whenever possible these discoveries should be made by the student for himself. On the other hand, as Stickler points out, "If a difficult concept needs clarification, if expensive and complicated equipment is necessary, or if the undertaking is time consuming, the demonstration may have advantages." Even in such cases we believe that the responsibility for the mental effort needed to make the observations and draw the inferences should be provided by the student. Excellent materials, carefully prepared dissections, well planned experiments, revealing demonstrations and stimulating field trips are the tools of direct discovery. They are very important. In a quotation used by Stickler and repeated here, it is pointed out that "This direct study of material was the original source from which came the content of books, the subject matter of lectures, the substance of group discussions and of examinations...this was the source from which came the facts that yielded the fundamental laws and basic truths by which humanity has advanced."

One of the master teachers by the method of direct discovery was Dr. Ivey F. Lewis of the University of Virginia. In a walk through the woods, students would collect pine cones containing immature ovules. Back in the laboratory, Dr. Lewis would demonstrate the method of making hand sections with a casual manner that was deceptive in its impression of simplicity while giving a graphic account of the contributions to botanical knowledge of the earliest students of plant morphology. During all this, the rhythm of the puffs of smoke arising from his pipe was rarely disturbed. When the sections were examined under the microscope, the interest and enthusiasm revealed by Professor Lewis brought the thrill of original discovery to each member of the class. In the spirit of the occasion, students were transported from a twentieth century class room to the laboratory of Wilhelm Hofmeister as he for the first time interpreted the significance of his own hand sections of similar structures. Professor Lewis skillfully employed the thrill of discovery as a method by which the facts of science might be acquired.

In addition, the modern biology teacher has available many valuable tools of indirect discovery. These include attractively colored charts which show differentiation of structure and form more clearly than ever before; life-like models of vinyl plastic; latex reconstructions; projection slides in natural color; film strips which combine photographs, drawings, and script to present significant topics of biological interest; and movies, particularly those using time lapse photography, which condense processes and life cycles that may require hours or months for completion into a few minutes and which convey information more clearly than either the written or the spoken word. Indirect discovery is facilitated also by references to textbooks, scientific journals, popular magazines, and newspapers. The reference may include a paragraph, a picture, a chart, a well-turned phrase, a vivid description. Whatever its source, whatever its nature, it must be available at the exact moment needed else its significance is lost and its value reduced to the minimum. In my own teaching, the sources of this reference material made available to the student in the classroom range all the way from the most recent edition of a widely used textbook to a best seller on the Book-of-the-Month Club list, from The American Scientist to Time magazine, from The New York Times to The Tallahassee Democrat.

The tools of direct and indirect discovery are constantly being improved. The alert teacher keeps himself informed of such advances. The use of new materials not only increases teaching effectiveness but motivates learning to a remarkable degree.

Discourse, discussion, and discovery! These are the resources available for the effective teaching of biology. No one need be used to the exclusion of the others. No one is better than the others. Whatever the method, or combination of methods, in any analysis of effective teaching, we come ultimately to the teacher himself. It is his enthusiasm for his subject, his interest in young people, his grasp of the pertinent information in his field and its significance,--it is all of these which form that vital, yet intangible, pathway for exchange of ideas and inspiration between student and teacher. Just as the master painter blends his colors to produce a picture of great beauty so he who aspires to be a master teacher of biology must work out the proper balance of those resources which will transmit to youthful minds the fascinating story of the science of living things.

Discussion: The questions and answers were concerned primarily with the opinions of the speaker regarding construction of tests.

#### THE TEACHER AND PROFESSIONAL ATTITUDES

S. C. Wilson

Wayne University

After I had agreed, over the 'phone, to accept the assignment to speak on this subject, Dean Kaufman said, "Of course you realize that we are not concerned here with the teacher's attitude toward the profession of pharmacy. This Monday morning session is devoted to the teacher as an educator--to learning concepts, teaching concepts, etc., and what we want here is a discussion of the teacher's attitudes toward the profession of teaching." The full import of this statement did not penetrate until later--too late, in fact, to withdraw the acceptance--and so here it is, "The Teacher and Professional Attitudes."

I have a rather definite impression that when teachers in schools and colleges of pharmacy think of themselves as professional people, they do so in relation to pharmacy. That is, they think of themselves as pharmacists, as professional pharmacists, performing a special and highly professional kind of pharmaceutical service. They do not tend to think of themselves as professional teachers. They would, for example, tend to be members of the American Pharmaceutical Association and its local branch, and the state and local pharmaceutical

organizations, rather than the National Education Association or its state and local subdivisions. This would probably be most true of those who teach the subject of pharmacy. What evidence there is of professional teacher-consciousness is probably supplied for the most part by basic science and humanities specialists who are on pharmacy college faculties.

We can perhaps assume, here, that teaching is a profession. Certainly it requires special knowledge which is used in instructing, guiding, advising, and serving others. It is used as an example in illustrating the definition of the word profession in Webster's Unabridged Dictionary, and there are other evidences of its general acceptance as a profession. If lack of preoccupation with monetary gain is a requisite, teaching certainly does not fail to qualify here. A Portfolio of Teaching Techniques which I came across the other day listed, in a box on one page, the four marks of a mature teacher. They clearly depicted a well-adjusted, high-type, professional person. In a similar box on the opposite page, headed "Salary and Satisfactions", the portfolio listed a number of satisfactions--but not one word was said about salary. Most teachers have been told, as they entered upon their careers, that they would never become rich. Too many, however, have had the more unpleasant experience at one time or another of wondering how poor they had to remain.

However, university professors particularly, are accorded high respect and prestige. They are thought of as men of deep learning, devoted to the search of truth, scrupulous and honest, unworldly and wise. This is true the world over--in European countries such as France, where professors are civil servants, in the United States where many are employed by entirely independent corporations, and in Latin American countries, despite other contrasting factors. Here in the United States university teachers hold membership on many advisory committees to the President, especially those on major issues of public policy. They directed much of the work of the most important technical commissions during World War II--on atomic energy, radar, synthetic rubber and synthetic gasoline. They were present, as technical experts on the planning staffs of most American military headquarters. They sit on the Supreme Court. They help to direct the largest philanthropic foundations. They contribute an overwhelmingly large percentage to the ten thousand books published annually in the United States. They devise the processes on which modern industry operates. And they constitute by far the largest class to be listed in such directories as Who's Who in America. We might also mention the fact that two of the last seven Presidents of the United States have been

presidents of universities.

Yet with all of this evidence of the social recognition of university teachers, there are some indications of doubt on the part of the professors themselves as to appropriate levels of professional recognition. There was a time when the theologian, the philosopher, or the historian looked with some misgiving upon those who worked in physical, chemical, and biological laboratories. Science seemed a smelly, manual, and pragmatic sort of occupation. Now it is accepted, and the natural scientist in his turn has become somewhat skeptical of the economist, psychologist, sociologist, and anthropologist, attempting to claim the mantle of academic respectability with their "social studies." However, one thing has tended to unite the two, and that is the appearance of an even less "academic" intruder, the specialist in education. We have tended, in the past, to place a heavy emphasis on thorough preparation in our individual specialties, and to place little if any weight upon preparation for teaching. This is unfortunate, and is, I believe, changing in that more attention is being paid to the latter. This is the reason we are here this week attending this Teachers' Seminar. On the other hand, educational specialists have not studied the problems of teaching at the college level as thoroughly and as completely as they have at the primary and secondary school levels. In a few places they are now beginning to do this. That is why Dr. Coulson and Mr. Klinge are here at this Seminar. They are part of a segment of forward-looking educators interested and willing to come here and help a group of content specialists with our teaching techniques.

There are a number of requirements necessary for an occupation to be considered a profession, but the most basic are probably the aims and objectives involved. The functions of a teacher in this twentieth century, his contributions to society, may be summarized as follows:

1. He must transmit the accumulated knowledge of the past and interpret it with reference to the present.
2. He must be able to take this knowledge of the present into the future, because he is guiding his students in a society always evolving. At the very least, the teacher must understand major trends in contemporary civilization, and prepare the young to meet adequately the problems they will encounter as they approach maturity.

3. He must augment the first and vitalize the second by adding to the accumulated store of knowledge through research.

There is a possible fourth function, but one not as completely recognized as the first three, and this involves the question of whether the teacher should be an active agent for change. Should he, for example, not only foresee what is likely to occur and prepare his students for these eventualities, but should he not also, in part, determine what does occur and prepare his students to assist in achieving the desired changes? The teacher, in such a role, would be far from neutral. He would be deliberately reinforcing certain trends and opposing others. It is at this point that the position of the teacher in many societies becomes ambiguous, and it is at this point where we are faced with the necessity of distinguishing between academic freedom and subversion, between liberty and license. Does the teacher have the right to teach what he pleases, or is the basic fundamental here not the right of learning, in which case teaching becomes not a right, but a privilege? However, without belaboring the point further, I would submit that with these three, or, if you prefer, these four major aims or objectives, teaching would tend to be ranked as a profession--provided, of course, we fulfill these functions. Perhaps we should take a look and see how we are doing.

We pride ourselves, of course, that our curricula are based upon a sound philosophy which runs through them like a golden thread and binds them together. But let us start with the grade school. Here we introduce our youngsters to the beginnings of their formal education with an approach based on a philosophy which could hardly be classed otherwise than as one of Romanticism. Here the emphasis is subjective, on the self, and on the development of the self, on the potentialities of growing into an important adult human being. True, it is expected that this adult human being will be a self-sustaining and contributing (economic and otherwise) member of society. However, the emphasis is not on the result, but is subjective, on the process of the development.

In college, the philosophy changes to one of rationalism. Here the self is subjugated and the mastery of knowledge is the important thing--a growing mountain of knowledge, every grain of which must be examined, analyzed, synthesized, explained, catalogued, and mastered. We then turn our graduates out into a world in which the dominant philosophy is characterized as one of pragmatic materialism, where profits are paramount, returns carefully calculated, and the accumulation

of possessions is the recognized escape from insecurity. Combined with these last two I detect more than a trace of stoicism, which has crept in during the past few years with the advent of compulsory military service, and which stems from the necessity to voluntarily dedicate one's self--one's life if need be, or at any rate a few years of it--to a large-scale national effort. We need not be surprised after all this if some of our graduates are more than a little confused. Our lives are presently characterized by confusion, apprehension, unrest, insecurity. Much has been written about the dynamic nature of our times, that the only thing which is constant is change, and that the rate of change is accelerating. This acceleration cannot, of course, go on indefinitely. It indicates a period of crisis during which major adjustments must be made. After the crisis relative tranquility may be restored, but this may not occur for generations. In the meantime, just as other professions (such as pharmacy, medicine, and all the rest) we need to adjust ourselves to the accelerating pace in order to more adequately prepare our students to meet the problems of the future.

These crises are recurrent. The present one is of major importance and will require numerous and lengthy adjustments the extent of which we cannot now foresee. It would appear to stem from the tapping of new and prolific sources of energy. For centuries man relied upon his own muscular energy, that of domesticated animals, and obtained some power from windmills and waterwheels. However, beginning with the invention of the steam engine by James Watt, sources of energy have been discovered the results of which we have only begun to experience. Our ideas of distance and time in relation to travel have been greatly reduced. In communications they have been almost eliminated. Distances are no longer a defense against attack. The frontier, as a world safety-valve against economic and social pressures has disappeared. There is now nowhere left to go to escape either from our enemies or from our friends, so we will have to learn to live with them. We must therefore put more emphasis on social studies and citizenship. We will, in the future, have to be more concerned with the development of attitudes than we have been in the past. The mere transfer of factual knowledge will not be enough.

It has been truly said that "Experience is the best teacher." It has been just as truly said, however, that "Experience keeps a dear school, and only a fool will learn in no other." The acquisition of what has gone before, cognitively, saves the time, pain, and expense of acquiring it experientially, and the student who acquires it thus, has an advantage over those who have gone before. The educative

process can therefore speed up the slow process of adjustment, but it will require teachers who will fulfill their professional responsibilities to the greatest possible degree. They will take advantage of everything useful, both in content and techniques, and reject that which does not serve. They will recognize progress that has been made, but will not revere the past simply because it is past.

We are now in the process of adding a fifth year to our required curriculum in pharmacy. We may eventually add a sixth year. There is precedent for this in other professional fields. Somewhere along the line, however, teachers will be faced with the problem of doing a better and more thorough job without any further extension of time. The teachers of the future will solve this problem, too.

May I close with a quotation of an Arabic philosopher.

"A great teacher, if he is indeed wise, does not bid you enter the house of his wisdom, but rather leads you to the threshold of your own mind."

Kahlil Gibran

**Discussion:** It was suggested that (1) college professors are not disrespected, but rather, that the layman tends to assume an attitude of tolerance toward them, and (2) that some pharmacy teachers will identify themselves as pharmacists only when speaking to a group of retail pharmacists, whereas they should do the same before all groups to which they speak.

#### THE TEACHER AND PUBLIC RELATIONS

Troy C. Daniels

University of California, School of Pharmacy

It is the ambition of every institution, profession or industrial organization to achieve and hold a position of public confidence and esteem. The public relations of an organization can be good, indifferent, or intolerable, but they are inescapable. Interest in public relations has developed to an all-time high and appears to be mounting each year. Industry leads in public-relations consciousness; professions are alert to the value of public relations; governments are ever mindful of the importance of public relations and adopt programs designed to improve domestic and international understanding. Irrespective of the organization,

activity or professional group one may be associated with, ways and means of improving public relations is a subject for continuing discussion. An increasing number of industrial organizations are initiating formalized public relations programs. Others which have sponsored such programs in the past are expanding their activities for they have demonstrated to their own satisfaction that a sound public relations program is essential for their continued progress.

A good public-relations program avoids the use of propaganda as such but rather it seeks to establish constructive lines of communication with the public in order to promote a better appreciation of an organization, activity, or profession, its aims and objectives and the value of its services. In general, the primary objective of a public relations program is to develop a feeling of respect and understanding between individuals or groups of individuals in such manner as to be of mutual benefit to all parties concerned. A sound public relations program for pharmacy must include these broad objectives.

Education for international understanding is the objective of the United States Government in such programs as the Smith-Mundt Act (Public Law 402, 80th Congress) which Act embodies most of the elements normally considered to be involved in a satisfactory public relations program. It is cited here because I believe it represents an ideal approach to an age-old problem of increasing the mutual understanding between the people of this Country and foreign lands. Section 2 of the Act reads as follows:

"The Congress hereby declares that the objectives of this Act are to enable the United States to promote a better understanding of the United States in other countries, and to increase mutual understanding between the people of the United States and the people of other countries. Among the means to be used in achieving these objectives are:

- "1) an information service to disseminate abroad information about the United States, its people and its policies promulgated by the Congress, the President, the Secretary of State and other responsible officials of Government having to do with matters affecting foreign affairs;
- "2) an educational exchange service to cooperate with other nations in
  - (a) the interchange of persons, knowledge, and skills;

- (b) the rendering of technical and other services;
- (c) the interchange of developments in the field of education, the arts and sciences."

Pharmacy has a problem not unlike the problem facing the Congress at the time Public Law 402 was enacted, which is to promote a better public understanding of its aims and objectives and the value of its services in terms of public welfare.

Pharmacy's public relations, and the public relations of a school or college of pharmacy, are too frequently regarded as the responsibility of the administrative officers of the organization involved. To carry on a professional public relations program is not the job of any one organization or group of individuals. It is clearly the public duty of every pharmacist to contribute in every way possible information that will lead to a better understanding of pharmacy service. The distinguished chemist and educator Dr. Joel H. Hildebrand, in writing on "The Professor and His Public" (Chemical and Engineering News, Vol. 30, No. 47, 4934, 1952), states "...it is not the president, the alumni, nor the students who, so far as I have been able to observe, chiefly determine the public relations of the institution; it is its faculty. Their minds, characters, and performances are subject to the inspection of students and public, quick to see any faults which reduce a professor to the size of an ordinary mortal.

"Now most professors are able to see a relation between public opinion and faculty salaries, and there are few who disregard it for the sheer joy of thumbing their nose at society. We prefer an occasional raise in salary and, also, we like to be well thought of. But there is another, more important reason for him to strive for good public relations. He has an indispensable service to render to the public, which is to push back the bounds of ignorance, superstition, and prejudice that circumscribe mankind; to lead in the search for truth; to test all ideas and discoveries by the severe standards of mature scholarship; to pass on through his students to society at large not only his findings but also his critical and analytical methods."

Dr. Hildebrand then proceeds to develop ways and means available to professors for improving the public relations of universities. Pharmacy's problem of public relations, as I see it, differs only in the nature and scope of its services as compared to that of a university or other activity.

We are all mindful that the pharmacy profession urgently needs to improve its public relations. Public confidence and

acceptance of the intrinsic value of pharmacy is essential for professional growth and development. Without public confidence and esteem, significant progress toward the realization of professional objectives is unthinkable. Robert Abrams, Executive Secretary of the American College of Apothecaries, writing in the American Journal of Pharmacy (Vol. 126, 274 (1954) on "The Need for Better Public Relations," expresses the problem as follows: "Public relations is every pharmacist's responsibility; his own individual responsibility, and like charity, it begins at home....Anything accomplished, whether satisfactorily or otherwise, reflects back on all of us and, unfortunately, we are judged, not by the best, but by the worst, as far as public relations is concerned. There is no question that public relations-wise pharmacy has failed miserable to convey the story of the many contributions that pharmacy has made in keeping the American Public healthy."

Dr. Hugo H. Schaefer (J. A. Ph. A., Pract. Ed., Vol. 16, 349, 1955) states: "It is not our opinion of ourselves that counts, but the impressions which others get of the need for and value of our professional services to safeguard the public health. That in large measure determines our professional stature."

It is, of course, not surprising that the public is sometimes confused and fails to appreciate the inherent value of pharmacy's service. To illustrate this point, I would like to quote a poetic observation written by a Miss Amy Grief as published in the Baltimore Sun under the title "Drug-Store Dilemma":

"I go into a drug store, oft, to have a prescription filled, What's here? A lunch counter, where cheese sandwiches are grilled: A toy department--gimmicks for cadets to roam through space with, And Wild West costumes, plastic dolls, and crayons you can trace with. Then there are rubber things galore, lipsticks, face-creams, and rouge, And greeting cards, and crackers, boxed, all assortments huge, And literature in paper-backs, cigars and cigarettes, And candy, nuts, and magazines, and things for bassinets. And hair nets, strainers, brushes, combs, a lending-library, beads. Oh, yes, I find most EVERY-THING Man needs, or thinks he needs. I CAME to have prescriptions filled, I search and search in vain: But when I ask for medicine, they eye me with disdain. Is there a druggist in the house? Is there a man in white? My purchase may seem dull, but I want my prescription right! In that dark, hidden corner there's the drug shelf, but, somehow, The druggist's much too busy to fill

my prescription NOW! No greeting cards? No books? No toys? The druggist merely shrugs, What interests drug stores LEAST today? Of course YOU'VE guessed it! DRUGGS!!!

The teachers in our schools and colleges of pharmacy are in a most favorable position to contribute toward an improvement of pharmacy's public relations and I make the following suggestions for your consideration:

1) Classroom. Throughout the teaching career of the average professor hundreds of students attend his classes. The first contribution the teacher can and should make is to gain the confidence and respect of the student. Too few teachers are successful in this respect. The average teacher is accepted by the students in a completely indifferent manner. The public relations of a school or college suffers when a teacher goes to class unprepared; or whose lectures contribute nothing or little, to the students' learning the subject matter involved. The teacher who has and demonstrates enthusiasm for his subject and the profession can normally be expected to pass at least some portion of it along to his students. Teachers who lack the ability and skill to present concepts and ideas to others should I believe, overcome their difficulty or else give up teaching. Many teachers have found it helpful to join speakers' clubs such as the Toastmasters or take formalized instruction in public speaking.

One of the special problems confronting pharmacy teachers stems from the unsympathetic and frequently harmful attitudes some of our practicing pharmacists have for education. Unfortunately, a great proportion of our pharmacy students are exposed to the influence of such individuals at the time they are acquiring professional perspectives in a school of pharmacy. Too many pharmacists are prone to say to the student-- "Look, Joe, you don't need that. I have been practicing 'pharmacy' for a good many years and as you can see I have been a success. I know!" Other pharmacists thoughtlessly tend to grumble and complain to the student of things that are objectionable in pharmacy, pointing only to the bad side or weaknesses of the profession. This understandably leads to disillusionment and lowered student morale. I have no easy solution to this problem, but two suggestions for the instructor come to mind: (1) gain and maintain the respect and confidence of the student; and (2) make the student realize that the rapidity of change in every field today is such that current needs and current practices do not remain current, that the educational program is not designed to perpetuate pharmacy practice as it has been in the past or as it is today,

but rather that it offers him the opportunity of gaining an educational background that will enable him to keep pace and grow professionally throughout a lifetime of service.

2) Seminars for Pharmacists. The need for continuing education for the practicing pharmacist is generally recognized and requires no detailed elaboration here. Every teacher in our schools and colleges has the responsibility and obligation of contributing to this activity. The pharmacists in the community and state should be given the opportunity of keeping abreast of new developments in pharmacy and the allied Health Sciences. Such programs should not be restricted to technical or professional information, but should encompass subject matter designed to aid the pharmacist in improving his contribution as a responsible citizen of the community. Moreover, the pharmacist needs to be constantly reminded of his role and responsibility in the recruitment and training of our future pharmacists. By taking advantage of the opportunity to inform members of other health sciences of the educational background of the pharmacist and the services of pharmacy, the teacher is able to make a substantial contribution to the overall problem of improving pharmacy's inter-professional and public relations. He should understand the importance of quality student recruitment, encouraging only those students whom he believes possess the character and ability for the study of pharmacy; he should be urged to talk to his student employees in terms of the good things in pharmacy and the opportunities it offers for public service; and he should demonstrate to the student his unfailing respect and observance of the code of ethics that serves as a yard-stick to evaluate the pharmacists social obligations and moral responsibilities. By so doing the pharmacist will contribute immeasurably to the improvement of student morale and, even more important, he will be responsible for helping to develop young men and women with a sense of moral and professional values.

3) Communication with the Public. Members of our faculties need to actively participate in community activities. A school or college of pharmacy should offer speakers and accept every opportunity to have a member of its staff speak to lay organizations, service clubs, high schools, junior colleges, and other organizations. Such programs when carefully planned will improve pharmacy's public relations and at the same time interest able students in pharmacy as a career. In connection with this activity, audio-visual aids can be used to great advantage. The University of Pittsburgh, School of Pharmacy, was to the best of my knowledge the first to make use of a color sound-slide film for improving student

recruitment, professional and public relations. It is reported that this project was highly successful and a detailed examination of the program is recommended for your consideration. More recently other schools have adopted similar programs.

4) Interprofessional Relations. Members of the faculties of our schools and colleges have many opportunities to appear on programs sponsored by our allied professions. The average pharmacist appears to have a pronounced inferiority complex. He is inclined to be subservient to the physician; rather than a colleague. He relies to a very large extent on the reaction of others to determine the pattern of his professional conduct. I need only cite the definition of substitution, as promulgated by certain selfish interests, to indicate one aspect of the nature of the problem. There is need for a precise definition of substitution, in order that the pharmacist may exercise his own judgment based on informed opinion.

5) Miscellaneous Ways and Means by which a Teacher and a Faculty Can Improve Public and Professional Relations. The following activities have been reported for the most part in Vol. 1, No. 3 of PRxchange, a newsletter of public-relations ideas for schools of pharmacy sponsored by the AACP-ACPRA Joint Committee on Public Relations, and are included here for your consideration.

(a) At Butler University, School of Pharmacy and also at other schools, a pharmacy college advisory committee made up of prominent pharmacists in the State or community has served to establish an effective "two-way street" for communicating information about the school of pharmacy.

(b) At the University of Texas, and Rutgers University a Pharmacy Extension Service has been established that serves by offering seminars and conferences in various parts of the State. At the University of California we have had limited experience with a similar program offered through the University Extension and in general it is found that such programs are well received and have a great deal to offer by way of extending lines of communication.

(c) "Open House" and conducted tours through the schools and colleges of pharmacy. Many schools have used this method to give the public an opportunity to have a look at pharmacy education. It is desirable to maintain this activity at all times, special arrangements should be made for interested high school students and other interested groups. Following the completion of new facilities for pharmaceutical education at

the University of California more than 8,000 people visited the school during a dedicatory period of less than one week's duration.

Dr. William G. Wilcox, Director of Public Relations at the Ohio State University and an ACPRA member of the Joint Committee offers the following check list of public relations ideas:

"First appoint a public relations and promotions committee with a representative of the official school's Public Relations office as an ex-officio member.

Second, re-examine all mailing pieces used to promote the school through high school advisors, and those used in response to requests for information about the school. Are they up-to-date? Is the type large enough (9 pt. or larger)? Have illustrations been used? Is it attractive and worded at the understanding-level of the audience for whom intended?

Consider a special High School Day to which selected seniors from high schools in the area served by the school are invited. Publicize, using names of visiting seniors and hometown addresses and have your school publicity office send to hometown newspapers.

Consider a special Open House Day to which residents of the locality are invited. Perhaps local Pharmacists who are also alumni could be asked to assist as hosts, thus building their prestige among the townspeople and enlisting their continued loyalty. Publicize, using their names.

Encourage local pharmacist organizations to create scholarship funds for the outstanding high school senior interested in studying pharmacy. Suggest to officers of the local group that they invite the local press to get pictures of the award of such scholarships, and issue stories explaining how the scholarship is being maintained, and the need for young pharmacists."

In conclusion, I should like to emphasize that the teacher in a professional school or college has duties and responsibilities that extend beyond the classroom and that primarily these duties relate to the establishment and use of those lines of communication that will enable him to inform others of his activities and their importance for the common good. By making full use of these opportunities the teacher can contribute immeasurably to the improvement of pharmacy's public,

professional and interprofessional relations and to the common goal of helping to put pharmacy's house in order.

Discussion: The principal items of this discussion were: (1) Television is one of the best ways of furthering public relations efforts for the college and its staff. However, one must discuss and/or demonstrate something which interests the public, e.g., narcotics, and show pharmacy's relationship to, and role in the subject. (2) Dean Hayman outlined the "Guidance Conference" program at his school. This involves periodic informal discussions with class representatives. During the two years the plan has been in operation, it has improved student-faculty relations.

#### SUMMARIES OF WORKSHOP SESSIONS

Monday p.m., August 8

##### Section A: Teachers of Introductory Courses

Reported by T. D. Rowe, Chairman

We had a large attendance at our section this afternoon and everyone present participated in the discussion.

We didn't solve all of the problems related to the courses in introductory pharmacy, nor are we able to bring you now a blueprint as to how to proceed in this field. We felt we did make some progress. We confined our discussion, as directed by Dean Kaufman, to orientation and courses in fundamental principles and processes. The remarks I am going to make represent the thinking of the majority of those attending our session.

The word orientation seemed to cause some confusion and at first we weren't all sure what we meant when we used it. Orientation seems to mean a lot of different things to a number of people. When using it to refer to a course some people have the conception of the course they took maybe 25 or 30 years ago. It has changed quite a bit since then. Nevertheless, it was agreed that orientation was a poor term to use and something like Beginning Pharmacy or Introduction to Pharmacy would be more meaningful and more acceptable.

It appears that the trend today for beginning pharmacy is a course taught as orientation in contrast to fundamental

principles and processes. Some schools are still teaching the latter, but more of them are teaching a beginning course in orientation or are planning to do so by the time the five-year program is in operation. The principles as a separate course seems to be dying out. This doesn't mean that all of the material in that subject is being deleted from the curriculum. The material that is needed and is valuable is being included in some other course, maybe preparations or physical pharmacy or some other course. It was our belief that integrating this material into other courses was more satisfactory than teaching it separately as has been the case in the past.

It was brought out in our discussion that much of the material in fundamental principles is covered adequately in the non-pharmacy subjects. Too much of it that is covered in pharmacy is on too low a level for students who will be sophomores or juniors when they enter pharmacy.

The course in Introduction to Pharmacy (Orientation) should cover such items as pharmacy literature, the curriculum, how to study, the scope of pharmacy including the various fields such as retail, hospital, manufacturing, etc., legal matters, fair trade and other items which would help to present a complete overall picture of the profession.

The primary objective in this course is to give the students the basic concept for proper indoctrination for the study and practice of pharmacy. This is a broad statement but is intended to be so.

In this course it is essential that the student be properly impressed with the importance of pharmacy. He must be gotten off to a good start. It was emphasized repeatedly in our discussion that if the students are not properly indoctrinated in this beginning course they will be handicapped throughout their college years or some may leave pharmacy altogether whereas otherwise they might stay.

Other objectives for the course were stated as follows:

1. To provide the student with an orientation to his local environment.
2. To provide the student with an understanding of the nature of, and the place of pharmacy in society and of the responsibilities of the profession of pharmacy.
3. To assist the student in obtaining a general knowledge of the legal requirements, associations, and literature of pharmacy.

4. To develop in the student an application of, and an interest in, the moral standards and professional conduct required of a pharmacist.

5. To develop in the student an awareness of the problems that face the profession and of the progress that may be expected in correcting these problems.

One other point which should be kept in mind and which was stressed in our section was that this introductory course is not an end to orientation. It is just the beginning and orientation must be carried on throughout the four or five years the student is in pharmacy. Every pharmacy course presents opportunities to help inform the student about some phase of the profession. The situation is comparable to that of ethics. The need for a separate course in ethics is generally recognized but it is not considered to be the answer to the problem of ethics. We all stress ethics in the various courses taught throughout the curriculum. The same thing applies to orientation.

#### Section B: Teachers of Advanced Undergraduate Courses

Reported by J. B. Sprowls, Chairman

The general objective set up for Section B was this: "How do we apply the educational principles presented by the morning speakers to the teaching of advanced undergraduate courses?" I will not pretend to you that we didn't stray sometimes from this objective, but that was the principal target of our discussion.

For this purpose, the advanced undergraduate courses were divided into three general areas. First, the advanced technology courses which include physical pharmacy and pharmaceutical technology. Second, the dispensing pharmacy, and third, pharmacy elections. I shall now give you the general conclusions which we reached: First, both the advanced technology and dispensing pharmacy courses lend themselves well to the correlation of basic principles with practical problems. Dispensing pharmacy presents the correlation of a greater number of subjects since it may be utilized to show the application of almost all of the courses in the undergraduate curriculum. Too, it was agreed that the best method of teaching the application of basic principles is by controlled experimentation. This is a method by which the student is permitted to reach desired objectives through the use of his own initiative (with appropriate guidance from the instructor

to see that objectives are properly selected and that time is not wasted). Methods for accomplishing this objective were discussed.

Third, the desirability of teachers of dispensing pharmacy working in drug stores was discussed. No definite conclusion was reached, although it was maintained that such work was not essential for the teacher.

Fourth, an attempt was made for finding a method of motivating students in the study of dispensing pharmacy. It was recognized that this is a difficult matter since so many prescriptions are not compounded. It was suggested that a suitable stimulus might be that of presenting the student with formulation studies or problems related to prescription specialists, in order to make him conscious of the problems involved including those found by the use of proprietary products. It was agreed that the course in dispensing pharmacy may be used in many ways to teach the student how to carry on proper public relations both with the public and with members of professional groups.

Finally, a discussion was devoted to the possible objectives which may be accomplished through the use of elective pharmacy courses. I will give these as separate conclusions because they are the objectives that we feel may be accomplished through the teaching of pharmacy electives.

First, the electives present the means of meeting the specific needs of a geographical area.

Second, they give opportunity to provide instruction in specialized areas which do not readily fit into a regular course in the curriculum.

Third, they provide the opportunity for the student to show initiative in the subject in which he is particularly interested. In some instances, the superior student is particularly motivated through this method.

Fourth, they provide the opportunity for a student to become somewhat familiar with a field of specialization which he feels he may wish to enter as a career.

Discussion: The principal points developed in the discussion on the report of Section A were: (1) The orientation course should be handled by a teacher or teachers of considerable experience; (2) Teaching by discussion rather than lecture was recommended; (3) The class should be handled

in small sections, and (4) The situation type examination was recommended.

The discussion concerning the Section B report developed these points: (1) Motivation in the dispensing courses may be increased by the study of formulas of various specialty products, including experimental work. (2) Such a procedure would not reduce the number of techniques applied, and (3) A dispensing teacher can keep in contact with dispensing pharmacy without working in a retail pharmacy.

## MORNING PAPERS

TUESDAY, AUGUST 9

E. J. Rowe, Presiding

## TEACHING ARITHMETICAL CONCEPTS

J. H. Kearns

Rutgers University

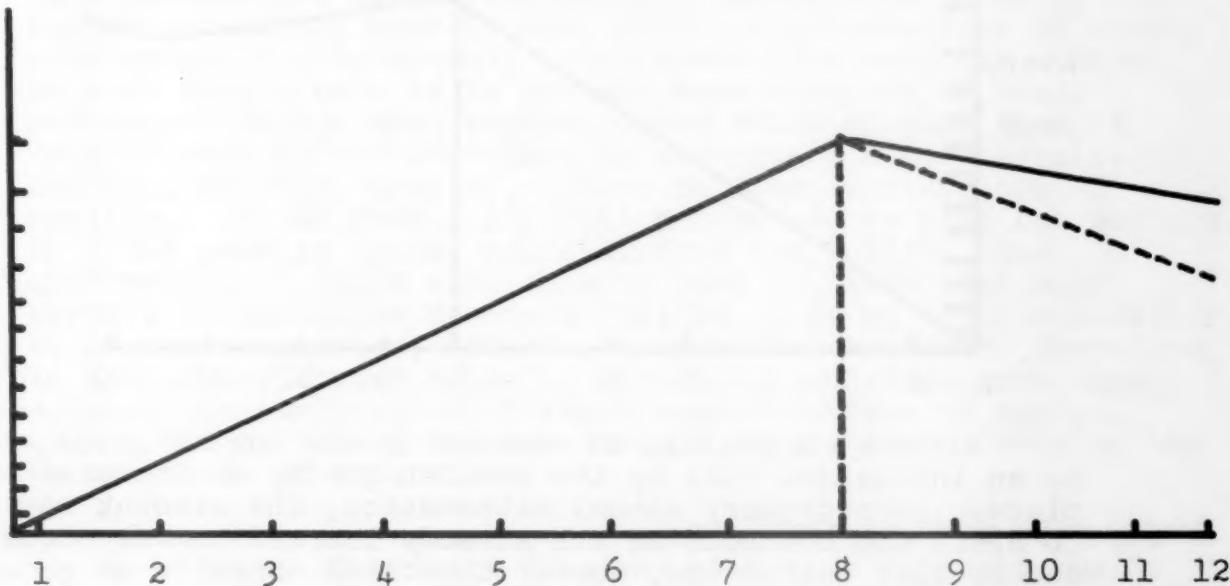
As a mathematician associated with a college of pharmacy, I was quite naturally curious when reference was made to the subject of pharmaceutical arithmetic. Since students are inclined to think that a mathematics teacher should be familiar with all types of mathematics, I had to find out, as a matter of self-defense, what the subject was about. After going through some textbooks, talking with the men who teach the course, and sitting in on classes occasionally, I satisfied myself that I at least knew what type of mathematics was being used in the course.

In the process, I became aware of the problems that our instructors were having in teaching the subject. Fortunately, my position at the college was such that I was able to take a more overall and objective point of view of these problems. After some time, I was led to draw some conclusions as to why some students have difficulty in learning pharmaceutical arithmetic.

The foremost conclusion, which will be no surprise to you, is that the trouble students have in learning pharmaceutical arithmetic lies, for the most part, in the "arithmetic", not in the "pharmaceutical" part. In other words, if a student has the ability to reason arithmetically, knows his arithmetical concepts, and is proficient in arithmetical skills, he should have little or no difficulty with pharmaceutical arithmetic.

Probably everyone who has had some experience in teaching some type of mathematics to a group of college freshmen has been struck by the fact that many of them seem to know so little about what is termed, "arithmetical concepts and skills". When one finds this situation, the natural reaction is to look askance at elementary and secondary school teachers and blame them for this seemingly unjustified weakness. Actually, this situation is not a result of poor teaching at the elementary or secondary school level. To illustrate, let us consider the results of a study conducted with a group of New Jersey students who were tested on their proficiency in arithmetic computation and arithmetic reasoning as they progressed through the grades.

Computation in this instance refers to the facility of using arithmetical skills with speed and accuracy, while reasoning refers to working out a problem using arithmetical concepts. Before presenting the results of this study, I wish to state that three things should be remembered: First, this was a group of better-than-average students; secondly, the entire group took four years of secondary school mathematics; and last, the teachers were exceptionally capable. Now, if the results of the tests on arithmetic computation were roughly represented, we would have the following:



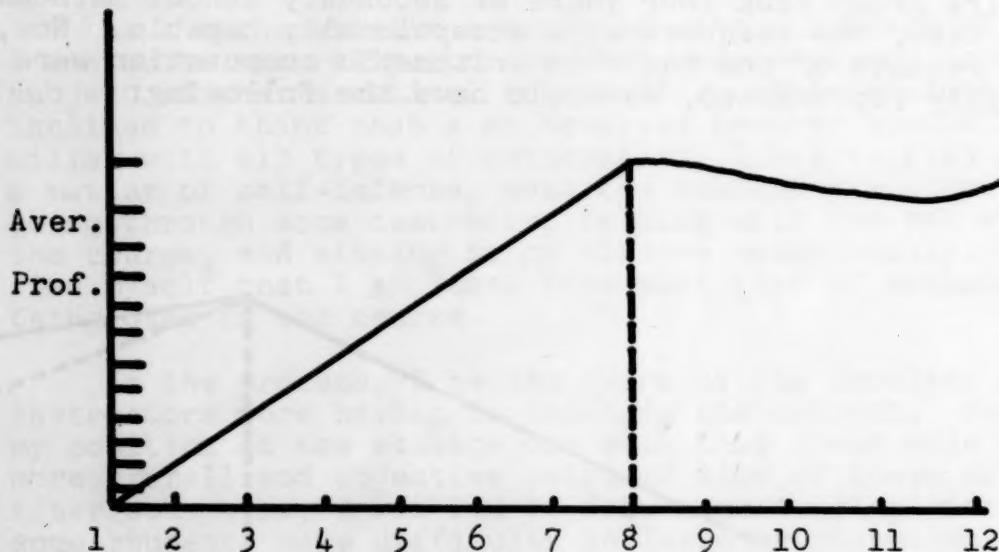
The students reached their maximum proficiency in computation at the eighth-grade level; then, a gradual decrease took place through the four years of secondary school. This

indicates that while the students were studying arithmetic, they maintained their skills and became more proficient; but when they studied mathematics that did not require a great deal of computation, they began to lose their proficiency.

If we were to consider an average group of students who did not have four years of secondary school mathematics and did not have exceptional mathematics teachers, it would be reasonable to expect that the dotted line in the above graph would represent the picture of their proficiency in arithmetical skills. There is more truth than slander in the statement that the average college freshman is no better than a sixth grader when it comes to arithmetic computation.

In contrast to the decrease in computational proficiency, there was no decrease in proficiency of reasoning in the same group of New Jersey students. Again, roughly representing the results, we have the following:

Arithmetic Reasoning



Although a plateau is reached in the eighth grade, there is an indication that by the twelfth grade, an increase takes place. In secondary school mathematics, the student learns to apply the concepts he has already learned to new situations; and he also learns new, non-arithmetical concepts in geometry. The fourth year of mathematics in this school was a special introductory course in college mathematics which, among other things, gave the students more of an insight into arithmetic concepts. Since the average student does not have that amount or type of secondary school mathematics, however, it would be

reasonable to assume that some decrease in proficiency of reasoning would occur, but not as much as the decrease in proficiency of skills.

Since the successful study of pharmaceutical arithmetic requires that the individual have at least as much as, if not more than, the eighth-grade level of computation and reasoning, it is necessary to teach some arithmetical concepts and skills at the college level. There are some who are greatly disturbed by this fact because they tend to regard anything arithmetical as definitely below the college level. This is not a realistic approach, for the meaning of number and number relationship only comes gradually as the individual gains insight into the fundamental assumptions and laws that govern mathematics. The time needed to accomplish this depends upon the ability of the individual, the opportunity the individual has to use the concepts and skills he has learned, and the type of teaching he receives which enables him to build on what he already knows.

Now, when arithmetical concepts and skills are taught at the college level, they should certainly not be taught in the same manner as they are in the elementary school. College students are mature enough and have sufficient grounding in the subject to be taught in a much more sophisticated manner. As a result, the basic fundamentals can be understood by the students enabling them to deal with the applications of these principles in a relatively short time. The only way I know to show what I mean is to present some examples of basic arithmetic from a more sophisticated point of view than is usually used at the secondary or elementary school levels. Before I do this, however, I want to make it clear that I realize a lot of what I say will not be new to you; but perhaps, by going over it again, you will find new insight into arithmetic. I would also like to make it clear that many schools of education devote a full year, or at least a semester, to a course entitled, "The Teaching of Arithmetic." Therefore, in the time allotted to me, I certainly cannot do more than scratch the surface. With these qualifications in mind, I would like to illustrate some mature approaches to some of the fundamentals of arithmetic.

Consider, for example, the number, 245.67. If you were to ask a group of college freshmen what this number actually stands for in terms of our number system, you might get the following, after some prompting:

$$\begin{array}{rcl}
 200 & = & 2(100) \\
 40 & = & 4(10) \\
 5 & = & 5(1) \\
 .6 & = & 6(1/10) \\
 .07 & = & 7(1/100) \\
 \hline
 245.67 & = & 2(100) \ 4(10) \ 5(1) \ 6(1/10) \ 7(1/100)
 \end{array}$$

How many do you think would convert this into the following:

$$245.67 = 2(10)^2 \ 4(10)^1 \ 5(10)^0 \ 6(10)^{-1} \ 7(10)^{-2} ?$$

Once the student begins to realize that all numbers are simply a means of representing quantities in a number system with the base ten, a great deal will be accomplished, and the student will be on his way to true number understanding.

In teaching the first-year mathematics course at Rutgers, I used the following example quite often. At the first or second meeting of the course, I would ask the students what the following were equal to:

$$(1) \frac{3}{0} = ?$$

$$(2) \frac{a}{0} = ?, \text{ where } "a" \text{ is any positive integer}$$

$$(3) \frac{0}{0} = ?$$

Invariably, the answer for (1) would be "0". When the students thought about (2), they were not quite as sure as they were with (1); but, again, the answer would be "0". However, when they got to (3), their faith in their knowledge of division would begin to falter, but bolstering their courage, they would either state that the answer is "1" or "0". Then, I would ask, "Are you sure of your answers?" This would be followed by more discussion and arguments than could be found in a debating society. Finally, the class would realize that they had never divided anything by zero before, which would be the opening for me to state that division by zero is not defined in mathematics. This would lead into the discussion of the importance of defined terms, assumptions, and proof in mathematics. After this sank in, they were no more disturbed by the fact that you cannot divide by zero than they were by the fact that you cannot hit a homerun in a football game.

Here is another example of where misunderstanding exists regarding the basic operation of division. Suppose you were

to ask a group of new college students what the following are equal to:

$$(1) \frac{2}{5} = ?$$

$$(2) \frac{3}{4} = ?$$

$$(3) \frac{2}{3} = ?$$

If the students did not possess pre-determined ideas of what these three are equal to, they would obtain the values by dividing the numerator of each fraction by the denominator and obtain:

$$(1) \frac{2}{5} = .4$$

$$(2) \frac{3}{4} = .75$$

$$(3) \frac{2}{3} = .66$$

However, division is defined in the following way: If  $\frac{a}{b} = c$ , then  $bc = a$ . If we apply this to the results, we find that  $5(.4) = 2$ ,  $4(.75) = 3$ , but  $3(.66)$  does not equal 2. When students see that .66 is not equal to  $\frac{2}{3}$ , they might say that the division was not carried out far enough. However, you could easily show that .666 or .6666, which are the results you would get by carrying out the division one or two more places, still would not give you 2 when multiplied by 3. Undoubtedly, someone will state that since .66 or .666 is very close to  $\frac{2}{3}$ , we would state that they are equal. Your answer would be that no, you could not; but you might add that it is a good approximation of  $\frac{2}{3}$ . This would then lead to a discussion of equivalents and approximates, which would greatly assist any pharmacy student who must use them and who very often depends on mathematics textbooks that confuse the two and unwittingly encourage inaccurate and false thinking.

Keeping to this example, we can demonstrate another thing that students do not fully grasp--the meaning of  $\frac{2}{3}$ . Usually, after some discussion, the students will agree that, among other things,  $\frac{2}{3}$  represents 2 divided by 3. However, you can quickly point out that it is not possible to divide 2 by 3, since no number can be arrived at which multiplied by 3 will result in 2. Hence,  $\frac{2}{3}$  is simply the expressed division of two numbers. In some instances, the division can be performed; while in others, it can not.

Now that we have defined "fractions", it is quite logical to discuss ratios, showing that a ratio is the numerical comparison of the dimension of two quantities. These dimensions might be length, size, weight, strength, etc., but the same dimension must be used in forming the ratio; for example, you do not have a ratio of weight to strength--it must be weight to weight, or strength to strength. It should be pointed out, however, that ratios are handled mathematically like fractions; therefore, they are fractions in arithmetic computation. I would discourage the use of:  $a:b$ , and use  $\frac{a}{b}$  instead, because there is no need to introduce new symbols which might confuse the students.

Continuing with fractions, the next important principle to be introduced is the operations that can be performed on fractions without changing their values. When students are asked what  $\frac{2}{3}$  is equal to, if not equal to .66, they will probably answer,  $\frac{4}{6}$ ,  $\frac{8}{12}$  etc. With a little analysis and experimentation, the student can be made to realize that the only thing that can be done to a fraction without changing its value is to multiply the numerator and denominator by the same number. This, in turn, leads to the general principle that if  $\frac{a}{b}$  is any fraction, then the value will not be changed by multiplying the numerator and the denominator by the same number,  $c$ , whether  $c$  be an integer or fraction; thus,  $\frac{ac}{bc} = \frac{a}{b}$ . Since  $c$  can be a fraction or an integer, division of the numerator and denominator of a fraction by the same quantity can be accomplished by multiplying numerator and denominator by a fraction, (i.e., division by 2 is accomplished by multiplication by  $\frac{1}{2}$ ).

It can next be shown that fractions and decimals differ only in that a decimal is a fraction represented in the following way:  $\frac{3}{4} = \frac{3(25)}{4(25)} = \frac{75}{100} = \frac{75(1/100)}{100(1/100)} = .75$ . Since not all denominators of fractions can be converted into a power of 10, (i.e., 10, 100, 1000, etc.), not all fractions have an equivalent decimal representation.

The next extremely important concept of fractions is that when we take  $\frac{2}{3}$  of a quantity, we imply that the quantity is divided into three equal parts and that two of these parts are being considered. Therefore,  $\frac{a}{b}$  represents dividing the quantity into  $b$  parts and considering  $a$  of these parts. When a student adds  $\frac{2}{3}$  and  $\frac{1}{2}$  and gets  $\frac{2}{3} + \frac{1}{2} = \frac{7}{6}$ , he is forgetting this concept. The student must be convinced that we can no more add halves and thirds and get fifths than we can add apples and peaches and get bananas; and that the only way addition or subtraction can be accomplished is when a conversion is made into like units. This is not done by any fancy rules, but simply by reverting to what was discussed about fractions. The student must convert the denominators into like units, and he will realize that if he multiplies the first by 2, he obtains 6; and that if he multiplies the second by 3, he also obtains 6; but he must remember that if multiplication is performed on the denominator, it must also be performed on the numerator; hence,  $\frac{2(2)}{3(3)} + \frac{1(3)}{2(3)} = \frac{4}{6} + \frac{3}{6} = \frac{7}{6}$ . Students are usually confused when multiplication and division of fractions are compared to addition and subtraction of fractions; for example, when  $\frac{2}{3}$  is multiplied by  $\frac{1}{2}$ , the numerators and denominators are multiplied together,  $\frac{2}{3} \times \frac{1}{2} = \frac{2}{6}$  without need for a common denominator. To explain this, we must point out that multiplication differs from addition by

showing him that we can multiply a fraction by 2 by either doubling the numerator or halving the denominator, and the reverse is true when dividing by 2. Gradually, we can lead him to the realization that,

$$c \frac{a}{b} = \frac{ac}{b} = \frac{a}{\frac{b}{c}} \text{ and } \frac{1}{d} \frac{a}{b} = \frac{a}{bd} = \frac{a}{\frac{b}{d}}, \text{ and finally } \frac{a}{b} \frac{c}{d} = \frac{ac}{bd} = \frac{a}{\frac{b}{c}}.$$

In other words, the student looks on the multiplication of  $\frac{1}{2}$  by  $\frac{2}{3}$  as  $\frac{1}{2}$  multiplied by 2 and  $\frac{2}{3}$  or  $\frac{1}{2}$  multiplied by 2 and divided by 3. When he does this, he will see no need for common denominators in multiplication or division.

If in the multiplication of fractions, the same factor appears in the numerator and denominator, they cancel out each other's effect on the final answer. From this rises the term, "cancellation". I am sure that you have all known students who were "cancellation happy"; and, on the slightest provocation, would strike out similar terms regardless of the context in which they appeared, getting such unique results as the following:  $\frac{2+1}{2} = 1 \frac{x(2-1)+3x-4}{x(2-1)} = 3 - 4 = -1$ .

I have always discouraged the use of the term, "cancellation" in my classes, preferring that students state that one factor divides in an equal factor with a quotient of 1. This takes longer to say, but it does a lot to cure the cancellation fever.

Division of fractions seems like black magic to some students, for all that they remember is the magical phrase, "invert and multiply". However, if division of fractions is approached in the following way, there should be little difficulty. Consider the example of  $\frac{3}{4}$  divided by  $\frac{4}{5}$ , which is set up as follows:  $\frac{3}{4} \frac{5}{4}$ . In this form, we simply have a

fraction in the form of  $\frac{a}{b}$ , where  $a = \frac{3}{4}$  and  $b = \frac{4}{5}$ . Realizing that when  $\frac{3}{4}$  is multiplied by  $\frac{5}{4}$ , the reciprocal, the result is 1, he can proceed to do this; but he must remember that since this is a fraction, he must multiply the numerator by the same quantity; hence,  $\frac{3}{4} \frac{5}{4}$

$$\frac{4}{4} \frac{5}{5} = \frac{3}{4} \frac{5}{4} = \frac{15}{16}.$$

The more the student is required to use the basic concepts of arithmetic and the less he relies on manufactured rules, the greater is the chance that he will develop the proper approach to any problem involving calculations.

Speaking of manufactured rules, there are probably more supposedly short-cut rules applied to simple equations and

proportions than to anything else. A proportion is an expressed equality between two ratios or fractions and, as such, is an equation. Expressed equality means that although we are stating that the left-hand member equals the right, this is not always the case--a point students are very likely to forget.

I am sure you have all heard the rule, "The product of the means equals the product of the extremes." It is my personal belief that we have a printer or type setter to thank for that one. Consider the proportion,  $\frac{a}{b} = \frac{c}{d}$ . You would have to stretch your imagination somewhat to decide which is "mean" and which is "extreme" but when the type setter decided that this took up too much room, he set it up this way:  $a/b = c/d$ , and this became,  $a \cdot b = c \cdot d$ , and finally, the colon (:) replaced the division sign and it became  $a:b :: c:d$ --you finally ended up with means and extremes. In this case, the equal sign and standard indication for expressed division were victims of the economy of printing. Unfortunately, at the same time, the basic idea that a proportion is an equation was also a victim.

The best approach to proportions is to use the  $\frac{a}{b} = \frac{c}{d}$ , maintaining the idea of an equation, and to forget about rules and go back to the basic axioms of mathematics on equality, which are:

1. Equals added to equals give equals.
2. Equals subtracted from equals give equals.
3. Equals multiplied by equals give equals.
4. Equals divided by equals give equals.

The student can then derive rather than memorize all of the laws of proportions. Here are a few using the multiplication axiom:

$$(1) b \frac{a}{b} = b \frac{c}{d}, \text{ which results in } a = \frac{bd}{d}$$

$$(2) d \frac{a}{b} = d \frac{c}{d}, \text{ which results in } \frac{ad}{b} = c$$

$$(3) bd \frac{a}{b} = bd \frac{c}{d}, \text{ which results in } ad = bc$$

The third, as you know, is the originator of the "means and extremes" rule, as well as of the term, "cross multiplication"--another rule that causes more trouble than it is worth. Some students think that the two fundamental laws of mathematics are "cancellation" and "cross multiplication".

Generally speaking, although it may be of some quick assistance to teach students rules rather than principles, in the long run, it is a waste of time. If you start with the

idea of teaching for meaning rather than for speed, the speed will come; however, the reverse is not true.

I remember the student who, when asked to solve the simple equation,  $x + 2 = 5$ , said, "You take the 2 and carry it across the bridge, change the sign and add it to the 5." I could not help thinking of him going home and telling his mother that he had a hard day in the mathematics class carrying numbers across the bridge. I hope that I have not made mathematics appear that tedious; and I hope, too, that I have shed some light on the reasons for some students' having difficulty with arithmetic at the college level.

Discussion: The following points were brought out in the discussion of this paper: (1) The speaker believed that many students have difficulty with pharmaceutical calculations (a) because they do not read the problems with comprehension, and (b) because they want to memorize a set of rules or formulas. (2) It was also suggested that (a) elementary and secondary schools probably were encouraging the use of formulas, and (b) that the calculations course was taught before the students were familiar with pharmaceutical terminology, both situations handicapping the pupil.

#### LABORATORY INSTRUCTION IN PHARMACY

E. P. Guth

Ohio State

The objectives of laboratory instruction must be based on:

1. the educational background of the student;
2. the relationships of these objectives to subsequent pharmacy courses;
3. the relationship of these objectives to other courses in the pharmacy curriculum;
4. the relationship of these objectives to professional needs.

The choice of laboratory exercises used to accomplish these objectives depends on:

1. its characteristics as concerned with illustrating the basic tools and techniques of pharmacy;
2. its importance as a pharmaceutical item;
3. its characteristics as concerned with the creation and maintenance of professional interest of the student;

4. laboratory practicality as associated with cost, appeal, time of preparation and equipment used.

This subject (pharmacy laboratory instruction) deals specifically with the laboratory instruction in the first course in Principles of Pharmacy or Operative Pharmacy, but because of its complex nature, the subject must by necessity include reference to the many aspects of the pharmaceutical curriculum including pre-pharmacy programs where these are established. The objectives of this course may be stated rather simply; such as, "teaching the student about some of the tools, techniques and terminology of pharmacy". In addition to these fundamentals, considerable attention should be placed on developing the professional personality and attitude of the student, although this is not exclusively the obligation of any one course in the curriculum. There is seldom any disagreement among educators as to these stated objectives. The principal differences arise on how to reach these objectives in the limited time usually assigned for this phase of the student's formal education. A clear understanding of the objectives of the entire pharmaceutical curriculum by all of the instructors in the college is essential to the establishment of the specific objectives of any segment of the curriculum. Since the primary objective of a college is to provide a curriculum, it is most essential that each faculty member clearly understand and appreciate the material given in each division of the college and in each course making up the curriculum.

When one considers the many specialized areas in pharmacy, each requiring an individual to have a basic training in pharmacy in addition to having some degree of specialized training, it becomes apparent that certain courses in the pharmaceutical curriculum must be considered as fundamental, and as such, each must contain material that is indispensable to all areas of pharmacy. Specialization training can be presented in elective courses. The ability of a teacher to make a selection of materials to be included in any course is by necessity related to his familiarity with the needs of the profession in its many areas, with the objectives and offerings of courses which precede his courses and those which follow. Failure to recognize these fundamental aspects usually results in the formulation of a hodge-podge of laboratory exercises designed mostly to keep the student busy. The statistical facts that 80-85 per cent of graduates of colleges of pharmacy enter the retail field, or that only 15-20 per cent of the prescriptions are compounded by the pharmacist, or that 20 per cent of compounded prescriptions are concerned with the solution of complex problems, are of little value in

selecting suitable exercises in a pharmacy laboratory. The frequency with which any given procedure or combination of procedures is encountered by a practicing pharmacist does not necessarily indicate the extent of training or emphasis that must be placed on any given procedure. Any one procedure or technique may at times be indispensable for the proper functioning of a pharmacist in the performance of his professional duties. Even though this is true, it is not practical to take the position that all known pharmaceutical techniques and processes must be included in the laboratory course or the curriculum, since if this were done, it would not be possible to expose students to all such items in the time of his formal education. The task of presenting satisfactory material in any course in the curriculum therefore becomes very important and difficult.

It must be emphasized here that the inauguration of the extended pharmaceutical education program to five years will have some influence on the nature of the material that can be taught in the pharmacy laboratory. This is particularly true if a two-year pre-pharmacy program is required for admission to the college of pharmacy. It is possible to include in the pre-pharmacy program such basic science courses as chemistry, physics, physiology, botany and mathematics. In addition, all other courses making up the pre-pharmacy program will assist in maturing the student. Furthermore, a student entering pharmacy college after two years of pre-pharmacy knows he wants to be a pharmacist and this is a tremendous help to the pharmacy teacher. Some observations made as a result of working with students with two years of pre-professional training may be of some assistance in focusing attention on what can be done and on some of the problems associated with improving the fundamental pharmacy course.

We have elected to begin the laboratory instruction with exercises in comminution after a preliminary orientation of the student with the use of the prescription balance and the various systems of weights and measures. We have found it necessary to give this instruction in the use of the balance since very few have had this training. The first exercise is a simple trituration of a copper sulfate with the three types of mortars and pestles. This exercise is intended to impress on the student that there are qualities of the three instruments that are different and important when associated with doing a specific job. This exercise serves to give the student some reasons for the existence of the three mortars and pestles and it is hoped that in subsequent problems where the character of the equipment is specified that the student will give this matter more careful consideration. The second

exercise consists of a formula written in the form of a prescription calling for lactose and carmine. Right away the student is told that the carmine is to represent some potent drug. He is directed to compound this mixture by using different procedures. He must compare his products as to appearance and is asked to make an evaluation as to the efficiency of the different procedures. He is directed to compare his product with his neighbor's; invariably these products vary enough to be differentiated by macro observation. He is directed to find the reasons for these variations. Perhaps the balances were not adjusted accurately; perhaps the weighing papers were not properly counterbalanced; perhaps an error in weighing was made; perhaps the order of mixing had something to do with the difference. He may find considerable carmine on the walls of the mortar or the end of the pestle. This simple exercise then gives the student some basic reasons for considering more carefully the subject of metrology, the balance, weighing techniques and mixing techniques. It also initiates him with general prescription format.

A third exercise would consist of a combination of some actual drugs. Since these are usually white powders and cannot be easily distinguished when mixed together, the student realizes that he must depend upon some sound mixing procedures to assure proper mixing, or he may include an indicator to aid in determining when the powders are thoroughly mixed. This prescription carries with it the directions for use. Here his experiences learned in compounding the first prescription are repeated and enlarged upon.

The next exercise is an official product--Compound Senna Powder presented in the form of a prescription. By this time the student has made some progress in his first course in pharmacognosy and it is possible therefore to begin some integration of the material in pharmacognosy with pharmacy. This exercise of course further expands the training of the student. He finds that the problems of comminuting plant tissue create different problems from the comminuting of crystalline substances. He learns that there are different problems in producing an homogenous mixture with vegetable powders than with pure chemicals.

Each succeeding exercise, therefore, would be selected to broaden the student's laboratory experience and at the same time cause him to repeat certain techniques so that in time these become second nature to him.

The selected exercises are mainly official products. These are presented in a prescription form so that the student gets acquainted with the United States Pharmacopoeia and National Formulary just as well as if he were directed to make a portion of an official formula. As the course develops, exercises become more complex, but do not include the type of problems encountered in dispensing pharmacy. Each laboratory exercise contains a few study questions. These questions are designed to emphasize the salient features of each experiment and should be answerable on the basis of the knowledge gained in performing the experiment or by association with the general lecture material. References to official books or commentaries is encouraged by having these references in the laboratory so that they are easily accessible to the student at the time that he is doing his laboratory work. It is frequently necessary to go with the student to this reference desk and assist him in finding the information he needs. At this level of training a great deal of careful leadership is essential to the establishment of good study methods for the student.

In setting up these laboratory exercises, one of the most difficult problems is in devising questions that will bring out the main objective of the experiment. We find we have a tendency to ask questions that are related to the experiment, but cannot be answered on the basis of the experience that the student gained in doing the exercise. We are well aware that the student is interested in knowing what drug products are used for and perhaps is interested in knowing how certain compounds may be synthesized, but these questions may be more properly asked after the student has had courses in pharmacology or organic pharmacy. The inclusion of such questions at this level tends to confuse the student as to the objectives of the course. If suitable questions relating to the fundamental objectives of the course cannot be asked as a result of a student doing a given laboratory exercise, then this exercise is probably not worthy of inclusion in the laboratory. There is no excuse for this to occur, since there is no shortage of suitable projects for a laboratory demonstration. As a matter of fact, the big problem is associated with making a representative selection of exercises.

It is also possible to arrange the laboratory syllabi so that students will do different exercises, each having the same or similar objective. For example, instead of having all students make zinc oxide ointment, have some make ammoniated mercury ointment. There is no real good reason why every student must make both products, since the fundamentals of preparing these two items are quite similar.

There are some instructors who believe that every student should make every official product. This approach has some merit, since this not only assures that the student will be exposed to all of the official products, but in so preparing each one he will develop certain skills so that they are more or less automatic. Furthermore, many problems that occur in dispensing pharmacy can be solved by reference to similar situations or conditions that occur in the making of an official product. For example, in our dispensing laboratory we have the prescription:

Rx	
Chrysarobin	4 grams
Starch	8 grams
Zinc Oxide	8 grams
Petrolatum	16 grams
M. ft. ung.	

This product is difficult to prepare so that it is free from gritty particles when compounded as written. If the procedure directed by the U. S. P. for making Chrysarobin ointment is followed, there is no difficulty.

Many other examples can be given illustrating this point. Now if Chrysarobin Ointment is deleted from the official books, this item is most likely to be deleted from the laboratory exercise. The deletion of this item from the basic laboratory may not be wise, since it is probable that the above prescription will continue to be prescribed and will occur in many medical handbooks. The deletion therefore of a product from an official book may at the same time delete a fundamental pharmaceutical principle and in so doing may create a gap in the student's training. It is necessary therefore to study and make a careful selection of laboratory exercises so that the indispensable techniques are brought to the student's attention. Since time usually does not permit the making of all official products and since deletion of products occurs with revisions of these books, it is necessary to design the laboratory material on the basis of the fundamental needs of the student as outlined at the beginning of this paper. In addition, some way should be invented or devised whereby the student could be encouraged to read objectively the older references as well as the modern ones. Also, once the beginning laboratory material is established as representing basic and indispensable material, the problem of getting the student to retain this knowledge and integrate it with other courses in the curriculum should receive considerable attention. The solution to this problem of teaching how to transfer and to apply technical knowledge

is after all one of the basic reasons for having a school or college and each and every instructor in each subject is equally responsible in this objective. The general procedure in beginning pharmacy laboratory is therefore based on the idea that the student has a background and interest such as to start the laboratory experience in pharmacy at much the same level as is customary with the student who enters directly from high school, but to accelerate and raise the general educational level rather rapidly. If this is done properly, at the end of the first year the student is expected to be fairly competent in the handling and understanding of most of the official processes and techniques of compounding. He is expected to be competent in the compounding of simple prescriptions. This objective has been reached fairly satisfactorily; however, continuous revisions are made in the laboratory material in an effort to strengthen the program. Certain types of material that have been conventionally included in the beginning pharmacy laboratory such as the making of tinctures, fluidextracts, etc., have been transferred to the course in pharmacognosy. This was done with the idea that the course in pharmacognosy could be strengthened and more closely integrated with the field of pharmacy. This has worked out satisfactorily, and it is quite possible that through careful study, many other basic techniques and procedures that in the past have been considered to be in the domain of the pharmacy courses could better be handled in the other areas of the college of pharmacy.

This matter should receive considerable attention in our colleges by all the faculty. If done conscientiously, it should result in the betterment of not only the pharmacy laboratory, but all other laboratories.

Discussion: This discussion of this paper was quite brief. The speaker recommended that grading of laboratory work be based on "degree of excellence", to encourage increasing proficiency throughout the length of the course.

## NATURE AND PURPOSE OF HISTORY OF PHARMACY COURSES

Glenn Sonnedecker

University of Wisconsin

The nature of the history of pharmacy is simply that of history,--history focussed sharply on our own field. Its purpose is to stimulate, illuminate, enrich, clarify, and systematize our thinking about man's previous experience related to supplying drugs.

In ordinary history courses, pharmacy usually disappears from view behind the looming features of great men, movements, and ideas. In history of pharmacy courses, the pharmacist--in one form or another--holds the center of attention, playing his role on the world stage, not as an isolated figure, but against the background of the society of his time and place.

If you think that the study of history has an important place on a university campus, you probably view the history of pharmacy as a strategic bridge between the social sciences and what can be a rather narrow technical specialty. If you think that the department of history is little more than a parasite on the university community, you will view the history of pharmacy as largely a waste of time, which had best be occupied by another course in science or business. You would agree with the occasional scientist or business man I meet, who states contentiously that he is interested in the future rather than the past. Frankly, I have never noticed that these people are any better prophets or fortune-tellers than persons with a knowledge of history, or that they have richer experiences or more important goals in life. But then I may be prejudiced!

True enough, you do not need history to perform your technical function effectively. You do not need history to synthesize a new compound, to determine the market for it, or to fill a prescription for it. Yet, there is more to life and to a profession than that. Teachers are always tilting against indifference, ignorance, disillusionment, and money grubbing--and pharmacy teachers are no exception. We think that the history of pharmacy, properly taught, offers one tool to help make pharmaceutical education a liberalizing and stimulating experience. We all know that no instruction called history of pharmacy or by any other name will guarantee to the average student professional dignity and integrity, and a socially

responsible and satisfying career.

There are, however, certain objectives we dare hope to reach in teaching the history of pharmacy. Blauch and Webster expressed them well in recommending three semester-hours or more of history of pharmacy for all types of curricula. In the workshop we held at the Teachers' Seminar last summer I elaborated them somewhat in the following five reasons for studying the history of pharmacy:

(1) To meet the problems and opportunities of pharmacy from the vantage point of historical perspective and in the light of previous experience;

(2) To obtain a clearer sense of pride, dignity and purpose through understanding the professional heritage hammered out by the efforts of predecessors;

(3) To see and accept our social responsibilities--through which scientific knowledge becomes fruitful--by familiarity with pharmacy's role in society;

(4) To understand the influence of professional, scientific and social developments in various societies and historical periods that led to pharmacy as we know it today;

(5) To enhance our interest in, and enjoyment of, the profession by becoming acquainted with pharmacy in other lands and with the historical and cultural aspects of our concepts, symbols, equipment, processes, drugs, and services.

Not all of these purposes can be met adequately in the usual survey course of three semester-hours. There is some danger in trying to cover too much ground; and the teacher may slant the course toward the strengths of his own interest and knowledge, keeping in mind the needs of the students. The selection and the sequence of topics often are not so inflexible as in a technical course, although this must be handled with discrimination.

As a teacher gains experience and knowledge he may want to develop specialized elective courses or seminar work around topics that are slighted or ignored in the survey course. There is room for experimentation here; and a course may be selected from a wide range of material so long as it has significance for the student, a unifying theme, and logical continuity. Some random examples are the history of drug standards; or pharmaceutical economics; of pharmaceutical literature; of drug therapy; of pharmaceutical law and ethics;

of pharmaceutical chemistry.

Whatever the scope of a course, there are some general teaching principles and practices to be considered, which may help to clarify the nature and further the purposes of instruction in the history of pharmacy. Here are six short commentaries, open to further discussion, which revolve around recurring questions.

(1) A history of pharmacy course ordinarily should have a topical framework. The Kremers-Urdang text exemplifies that approach, by portraying the development of education, legislation, organizational structure, and so on, for each principal country. One could carry that a step further by abandoning the national compartments, so that pharmaceutical education or legislation would be discussed on a comparative international basis for at least the post-medieval European cultural areas. It remains to be shown whether that would be an improvement. In any event, it seems clear that some kind of topical approach shows the evolution and structure of a segment of pharmacy more meaningfully than portraying chronologic cross sections of pharmacy as a whole.

We should also try to make the student see the events within the context of their time, indicating the consequences and the relationship to us, without drawing invidious comparisons with our own time. After all, quite possibly the development of the wheel required just as much genius and was just as revolutionary as the release of atomic energy.

(2) The history of pharmacy should be taught as accurately and as frankly as we know how. I mention accuracy (not to be confused with pedantry) because most teachers of the history of pharmacy are untrained in historical method. They are trained as scientists. And scientists in some fields have been notorious for throwing aside their standards of criticism and objectivity when they step out of the laboratory to speak and write on history. The search for what we consider truth has the same importance in social studies as in science studies; and at best the precision attainable in a historical field will be much smaller than that in a scientific field. But the history of pharmacy is not a romantic semi-fictional tale, or necessarily a glory story. It is a forthright, honest analysis of the problems as well as the triumphs of pharmacy, presented as vividly and interestingly as we can. Dates should be stressed in teaching only when they represent milestones, set guideposts for orderly thinking, and help place developments in proper sequence.

(3) Emphasis should be placed on the origins, evolution, and application of ideas, on the development of trends or lack of them, on recurring problems and attempts to meet them. This means that anecdotal and biographical material will be a spice rather than a framework in teaching. In mentioning origins, I might point out that "firsts" have a fascination for the historian, one might say a fatal attraction. As every scientist knows, a "first" may be either a rather simple or complex synthesis of several subsidiary ideas; or it may be only an old idea taken over into a new field--as sugar-coating of pills was probably taken over from the confectioner's art. Thus the meaning of "firsts" may vary according to one's interpretive bent or stage of ignorance. We need not shun the word, but respect it.

(4) The history of pharmacy should be taught on an international basis. American pharmacy has neither existed long enough nor developed far enough professionally to deserve the lion's share of a course flying the banner of a general survey. But because we live in America and practice our profession here it deserves substantial analysis, more than a strictly world view or chronologic view would allot to it. The proper division of time is something to argue about rather than to report. One reasonable approach might be to devote a fourth of the available clock hours to each of the following: ancient times, medieval period, modern Europe, and America. Each topical strand of the development of pharmaceutical service and science in Europe and America should culminate, I think, in an evaluation of our contemporary scene. This is highly hazardous work, historically, since we cannot be sure of the consequences of current events, but advanced undergraduates should have our considered diagnosis and prognosis.

(5) If the pharmacy in our history lectures crowds out interpretive material from the general social context and from developments in related fields of medicine, science and technology, we are losing something important. Overcrowded lectures can be thinned out somewhat by assigned readings.

There is always time enough for visual aids that illuminate the topic as well as the screen. More charts, diagrams, sequence maps, and even graphs could be developed for history of pharmacy courses. There are short motion pictures that provide excellent general background on various periods and cultures.

(6) Instruction in historical pharmacy can be enriched by experimentation. It would be a good rule--not only for

history teachers--never to give the same course in the same way twice in succession. Break the class into discussion groups at least occasionally. Drop a topic that seems not too essential or successful and substitute a new one. Try the "buzz sessions" that were suggested at the 1954 Teachers' Seminar. Most pharmacy students will not be prepared to discuss most history topics, but the resourceful teacher can stimulate some useful attempts. Experiment cautiously in lectures with the "flashback" technique used in movies. Rearrange course units, or shift the emphasis. Through experimentation the course and the teacher can broaden, deepen, and grow.

These are some of the things that give history of pharmacy courses their particular character, indicate their purpose, and help to fulfill it. Whatever the nature and purpose may be, the quality of such instruction depends, of course, upon the quality of the teacher. For that reason I want to speak for a few minutes about personnel. After all students are molded for their careers essentially through the men on a faculty. And the particular courses are only the vehicle for them to impart systematically their ideas and their knowledge.

We are fortunate to have a number of instructors emerge who see the potential of the history of pharmacy as Blauch and Webster did when they said, "...no subject so readily lends itself to developing in the pharmacist the orientation he should have as a professional person, to producing in him a sense of appreciation for, and pride in, his profession." There must still be a number of other instructors who are drafted for a duty for which they may lack interest or insight, talent or training. Occasionally we still hear that, "Anyone can teach history." I suppose "anyone" could teach pharmaceutical chemistry, but it is difficult to teach in a meaningful, accurate, and interesting way. It is also difficult to teach the history of pharmacy in a meaningful, accurate, and interesting way.

Yes, it is probably less hopeless in the history of pharmacy than in pharmaceutical chemistry to aspire to a reasonable teaching standard without much formal training--if the teacher can invest a generous amount of interest, time, and talent. Some schools have been fortunate in finding this kind of man. Dare we say he is a "luxury" on a technical or scientific faculty? He should be encouraged and given all possible opportunities to develop a background in cultural and social subjects, and an ability to apply them to pharmacy.

There are useful courses on his own campus if he is given, or takes, the time to attend them. He can receive a stimulus through the American Institute of the History of Pharmacy. The time allotted for the exchange of ideas and information at Teachers' Seminars in 1949, 1954, and now this year, has been an appreciated opportunity. And since 1947 the University of Wisconsin has offered opportunity for the formal training that we probably all agree should be joined with the interest and talent of a teacher. This academic program offers possibilities for "old hands" in pharmaceutical education as well as for young graduates. I should like to recall to your mind, briefly, these opportunities, since they are unusual and still rather new:

First, there is the Doctor of Philosophy program based upon a joint major in the history of pharmacy and the history of science, or upon a major in history of pharmacy alone. Formal course work ordinarily will include all the courses given at Wisconsin in the collaborating Departments of the History of Medicine and the History of Science, plus a history of chemistry course in the Chemistry Department. The graduate student will have a full minor in the Department of History and some work in such fields as sociology, philosophy, and economics. Thus pharmacy's many-sided past and its present circumstances are put in the perspective of the developments and the relationships of adjacent professions, underlying sciences, and society at large--which so largely determine and explain what happens in pharmacy. From this vantage point, the graduate student does his doctoral research.

A foreshortened version of the program leads to the Master of Science degree, with a major in the history of pharmacy. Another possibility is a minor in the history of pharmacy, taken with a doctoral major in one of the other pharmaceutical specialties.

We offer post-doctoral work as the last of several possibilities for formal studies and research--creating opportunities for schools to improve the teaching of history of pharmacy and related subjects in professional orientation.

The growing recognition of the history of the professions and sciences as a branch of history and the place of history of pharmacy, specifically, in the curricular patterns of Blauch and Webster, undoubtedly means that a number of schools will consider improving or extending instruction in this area, as we convert to the five-year program. I believe that the diagnosis of pharmacy by The Pharmaceutical Survey and experience thus far will justify this further experimentation

with instruction in history of pharmacy and other forms of professional orientation. And as an occasional pharmacist becomes formally qualified in the social sciences as applied to pharmacy, I like to think that American pharmaceutical education will offer him a chance to show what he can do in teaching and research.

Only a few schools may have the necessary combination of desire and resources to provide a separate chair in the history of pharmacy. This will appear more feasible to the average school, however, if the professional orientation courses, required and elective, are brought into a natural grouping for the man best qualified to handle them: the instruction in ethics, orientation for beginning students, pharmaceutical literature, and professional communications, as well as the history of pharmacy.

Here is another interesting prospect: I should like to see a few deans take the initiative to establish a joint chair with another university department, just as you now sometimes find joint appointments between economics and sociology; history and agriculture; liberal studies and a scientific department. It might be a joint appointment for the history of pharmacy and the history of chemistry, or history of nursing, botany, or public health. A particular combination might develop both from the bent of the faculty candidate and the outlook of particular deans on the campus. I do think that a capable man whose Ph. D. represents a joint major in the history of pharmacy and the history of science will not only fill both sides of a joint chair adequately, but will hold his own with other historians on the campus. It seems obvious that a pharmacist in such a position would have an unusual opportunity to embellish the reputation of the college of pharmacy as well as enrich the instruction of students.

And every teacher of the history of pharmacy, whatever his vantage point or handicap, has an unusual opportunity to embellish his own life, standing as he does at the crossroads where pharmacy and the arts, humanities and sciences meet and merge. This vista he tries to share with his students. He will not reach all of them. In trying to he will be encouraged by the convictions he shares with men of the stature of Edward Kremers and George Urdang. Each of us must find his own way into the subject, which may seem either deceptively simple or needlessly baffling. But the goal we reach toward can hardly be depicted more clearly than in the statement by George Urdang at the first Teachers' Seminar six years ago:

"History cannot be learned merely by memorizing facts," he said. "It must be perceived. The individual facts gain their meaning and importance from the general context in which they are standing and by which they are bound together as products of and as factors within the general development. That means that the student of the history of pharmacy becomes of necessity so interested in society and the part of his profession in the life of the community and the commonwealth at large, that he finally becomes ambitious in the promotion of this part, its demonstration and recognition.... It is the goal of the instruction in history of pharmacy to make the pharmacist a citizen of the world of culture, a 'cultured' man on the basis and for the sake of his profession and finally of mankind."

Lloyd E. Blauch and George L. Webster. The Pharmaceutical Curriculum (Washington, 1952), pp. 213-4, 232-5.

Blauch and Webster. The Pharmaceutical Curriculum. p.162.

George Urdang and Glenn Sonnedecker. Teaching History of Pharmacy (Madison, Wis., 1950), also in Amer. J. Pharm. Edu., 14 (1950) 128-156; and Proceedings, Teachers' Seminar on Pharmaceutical Education (Storrs, Conn., 1954), pp. 157 ff.

Glenn Sonnedecker, "The Character of Research at the Doctoral Level in the History of Pharmacy," Amer. J. Pharm. Educ., 18 (1954), 239-249.

Discussion: These points were developed: (1) Wisconsin does not include local pharmaceutical history in its survey course, except as illustrative material. (2) Courses may well include developments which have led up to the extended program. (3) The course should be taught "on a prepared international basis" to give the student an understanding of parallel development and make him feel he is part of a world-wide group. (4) The history of processes, instruments, and techniques is not included in the course, although a lecture is devoted to the symbols of pharmacy.

## THE CONSTRUCTION AND ADMINISTRATION OF TESTS

J. Thomas Hastings

University of Illinois

Fortunately, or unfortunately, I am talking to you today about a subject with which we are all more or less familiar. I sometimes envy specialists like you. Not everyone mixes his own drugs, prepares his own prescriptions, and helps develop new pharmaceuticals. In my business of examinations--achievement and psychological testing--the situation is not so clear. Everyone is in on the act. Each one of you has some situation in which he is making tests for his own classes, or sitting in on committees which are constructing tests for wider curricular use, or using test results from examinations constructed by others.

The fact that tests are used so liberally--that so many of us are concerned with them--is in actuality an incentive for study of the basic process and the improvement of results.

The principles and practices of test construction and administration are quite meaningless unless we have a common understanding of basic theory of tests. What are they really? What are we trying to do with them? What makes a test a test?

It is my intent to set forth a very simple, straightforward theory of tests followed by a few basic principles of test construction, including administration and scoring, with an attempt to illustrate these in terms of actual testing practice--and then to finish by mentioning a few special ideas and practices that seem to be relatively new, useful, and taking hold in college classes.

My point of everybody being in on the act in testing was far from incidental. One of the major points in my basic theory of tests is that at least from the time we were very small children up to the time that we finally lose consciousness all of us have been and will be engaging in the fundamental process of testing whenever we are dealing with other people. This is not a claim that we are giving tests but rather that we are engaging in the process of testing. It is a straightforward statement of a fact which the experience of any one of us will bear out. Whether we are dealing with the butcher, the baker, or the recalcitrant junior--who in a junior pharmacy course is refusing to remember the mathematics

he learned in the sophomore year--we are engaging in the process of collecting samples of behavior in order that we may predict how the individual will react to certain situations.

Put in a-b-c terms, we are doing these four things: we are perceiving a stimulus; noting what we believe to be the response to it; making an inference about the motivations, associations, and processes which went on between them; and, finally, using that inference to make a prediction. These four things--the stimulus-response-inference-prediction set--are the basic process of testing. You are using this basic process when you meet new colleagues at a committee meeting, when you are participating in a social engagement. Think back for a moment to the time when you were students in college. You watched carefully for the clues to special idiosyncrasies of new instructors. You changed your usual questioning behavior somewhat if someone else in the class asked a new instructor a question and received a bit of a verbal beating for having gone to the pains to ask it. You noted what you perceived as the stimulus--the student's question--and what you perceived as the reaction or response--the instructor's biting remarks. You made an inference about behavior (the instructor's) and in a very real sense you made a prediction. You based your own behavior on how you predicted the instructor would act in a given situation.

In any role-playing social behavior, our sociologist friends tell us, we get our clues as to how to play our roles by analyzing pieces of behavior of the people with whom we are dealing. We make decisions on appointing or electing fellow members to committees, decisions about our behavior in lecture room or laboratory, decisions about the brevity or complexity of our social conversation statements--we make these decisions with regard to exactly the kind of evidence that I have mentioned in sampling behavior--the stimulus-response-inference-prediction pattern.

It is true that some are more gifted at this process than are others. It is equally true that we are apt to be more conscious of the process in a new situation. This, too, has a bearing on test theory. In the new situation we are faced with the fact that we can collect only a few samples of behavior before we must predict. Knowing we have few samples, we are apt to feel less confident about our inference and our prediction. We may not stop and ask ourselves explicitly the question of "How many incidents do I need; how many samples do I need to achieve confidence in my prediction?" But we behave in general as though we are asking that question.

We are conscious of the fact that, in general, a single stimulus does not exist and that, therefore, the stimulus we are perceiving as the key one is located within a mesh of other stimuli, some of which may be quite forceful. Borrowing a phrase from communication theory, we recognize that there is noise with the communication--that is, there are irrelevant stimuli with the stimulus concerning us. This is always so, but it is critical in the new situation. We, therefore, appreciate it when we can obtain a number of sets of the stimulus-response-inference-prediction pattern on the individual with whom we are dealing. In test theory this repetition of incidents (or, as we call them in tests, items) has to do with reliability and therefore validity of our results.

The only proof that we need of the fact that we engage in this process I have mentioned is the fact that we do treat individuals differently. We react differently to the same response from different individuals. We impose different stimuli on different individuals in order to obtain the same response. We do this because we have predicted behavior. It is true that sometimes we have made bad predictions and have done the wrong thing. That isn't because we were using the wrong process but because we misused it.

There are three inherent difficulties, or points of possible error, in the appropriate functioning of this basic process. These same three points have their counterpart in formal testing. The first is that we are apt to collect too few incidents about the individual with whom we are dealing to allow us to have a reliable, valid prediction. A moment ago I mentioned the professor who gave a biting reply to a question by a student. I am sure that none of you would use one such incident to make a firm prediction, but the person next to you might use as few as two or perhaps three. In many situations we do this because there is not sufficient time to collect enough samples to actually give us confidence. We have to act on the evidence we have. It is true that many of us change impressions of people as we deal with them more. What we are really doing is correcting our faulty predictions by acquiring more samples of behavior of the stimulus-response-inference-prediction type.

A second difficulty is that of misperceiving the stimulus or the response--or perhaps making a faulty inference regarding the association between the two. The professor who made the biting remark in reply to a question may not have been stimulated to that kind of response from the stimulus we perceive, that is, the student's question. It may have been

a case of slightly fallen arches plus four bad hours in the laboratory with a rather ailing project to which he was actually responding. The rather negative response of a new social acquaintance to a hearty greeting on our part may not have been a negative response from his standpoint at all. Perhaps a slight nod of the head and a rather hoarse grunt are, by his standards, a rather extroverted, friendly greeting.

A third common error in the process is that of sampling one type of behavior and overgeneralizing our prediction to behaviors which are not relevant to the one we sampled. It is not uncommon to hear: "John wouldn't make a very good committee member on admissions policies--he even has trouble making a decision about what tie to wear." Or, we hear an illustration more to the point: "Bill should be very good in your junior laboratory course--he was one of my best students in history of pharmacy." You see in both of these cases the stimulus-response-inference process was probably carried through correctly. We can even assume that the stimulus and the response were both correctly perceived. It just happens that the individual making the prediction over-generalized from one behavior to another.

So much for test theory. I have tried to set forth the basic process in a non-test setting and to indicate the main, or most common, "error-points" in the process.

If this is the basic process, then what is it that makes tests tests? Tests take advantage of this process by applying it consciously and systematically. That is the first advantage of tests. The second and third advantages of the test over the basic process of testing which we have all used are control and speed, respectively.

Remember the difficulties which I said were practically inherent in the stimulus-response-inference-prediction set? The second of these was that of misperception of stimulus or of response and I included the fallacy of inference. Now, a well-constructed test is basically aimed at carefully controlling both the stimulus--that is, the key stimulus of any given instance--and the response. If there is a good definition for a test, it is that a test is a stimulus pattern applied identically to two or more individuals.

Control is attained in a test by so stating the item, so communicating the item--and here I speak of the usual classroom achievement examination--that it will have as nearly as possible the same meaning for all anticipated examinees. For example, I think most of us here have seen the kind of item

directed perhaps to juniors in pharmacy which says, "discuss the code of ethics for pharmacists." It is obvious that this stimulus may mean many different things to many individuals. It is not a clear-cut, controlled stimulus. One could discuss the code of ethics by writing about how long it is, the legal sound of some of the statements, and the generality of some of the items without ever mentioning any of the content of the code. "Yes," you say, "that's true, one could; but if any junior of mine ever did, I would figure that he hadn't been reading books or listening to lectures." You're right; he probably wouldn't have been, but that misses the point of this discussion. An ambiguous stimulus is not one which will give us the advantage of control--which will change the basic process of behavior sampling to a real test. The fact that he should have picked up clues elsewhere--in books or in lectures--makes his picking up of those other clues part of the test. The point is if you wish to make an inference concerning his response to a given stimulus, the stimulus must be clearer than the item just quoted.

If one were interested in obtaining some measure of understanding of the code of ethics from a class of juniors in pharmacy, one might better write the essay item something like this: "Choose three major points in the code of ethics and for each describe a situation in which that ethic would be relevant to the behavior of a pharmacist." If on the other hand, one should by chance expect the student to have memorized sections of or the total content of the code of ethics, he should so state the item that it calls for quotation, not for discussion. The point here is that if we think of the basic nature of the process and the possible errors inherent in it, we realize the extreme need for clarification of the stimulus. Tests, as opposed to casual or incidental pieces of observation, give us an opportunity to control the stimulus.

It is this power of control that we are after in a short-answer form--that is, multiple-choice, matching, true-false--when we carefully edit the item to make sure that there are no irrelevant clues by which the individual might choose the appropriate response or, for that matter, which may force him into an inappropriate response. We do not want him responding in any old fashion but rather we want him to respond within a narrow range of possible responses. Do you remember the true-false items you have seen in which every false item contained in it either the word "always" or the word "never" while none of the items which were keyed as true contained either of these words? In using such items we are certainly getting samples of behavior from the examinees. However, we cannot be certain whether the response is to our

intended meaning of the item or to the single word "always" or to the lack of that word.

We have seen multiple-choice items such as the one that started with "Which of the following statements is a recommended method for checking prescriptions?" and then this lead question--or stem, as we call it--is followed by five statements. If four of these five statements are not a method of anything but rather are descriptions of products or statements of fact and the fifth one is the one that is keyed as correct and it is actually the statement of a method of doing something, the examinee may very possibly respond simply to a concept of method without bothering twice about what we thought was the central idea of "for checking prescriptions." At the very least, all five alternatives, or choices, following the stem in this particular case should represent methods of doing something so that the difference in responses will have to deal with recommended procedures for checking prescriptions. The essence of this example is simply that a test, although using the basic process with which we are familiar, does carefully control both stimulus and response.

The inferential step in the process is controlled somewhat, or at least it is improved, by the very fact that we give the same tests to several--frequently many--individuals. In the less formal situation of working with colleagues in committee meetings it is seldom that we have the opportunity of seeing or hearing several different individuals react to precisely the same stimulus. In the test situation we have some check on the inference itself by noting the ways in which a large number of individuals react to the same thing.

The third advantage of the formal test is, as I stated, speed. In predicting the future behavior of a given individual or in predicting behavior from one set of individuals to another, the question immediately arises as to how many samples, how many incidents, how many items do you want in order to have some confidence in your prediction. In test language we say, "How many items do you want in order to have reliability?" In the formal test situation we enforce the stimulus and response rather than waiting for it to happen "naturally." If we were wanting to predict how a given individual will operate with a piece of equipment, such as a microscope, the test situation allows us to produce an input of a desired number of stimuli--or different types of microscope-use situations--and then to check the corresponding output of responses in a comparatively short period of time. To dramatize this speed factor, let us consider a case in which we wish to predict finger dexterity of a person for a

laboratory situation. Presumably we could follow the person about the streets watching him drop coins in parking meters, put caps on tire valves, and obtain stamps from the ordinary vending machine. His behavior, his responses, the way he operated would give us a basis for prediction of his finger dexterity. How many cases would we want in order to assume confidence in our prediction? This particular process could take a considerable bit of time. In a test situation we set up special tasks and instructions in such a fashion that the individual produces a quantity of the behavior which we are wishing to sample under fairly well-controlled circumstances in a fairly short period of time. This third advantage--speed--of the formal test over the raw basic process is one which we may very well keep in mind when we are wondering whether we want a discussion, that is, essay or free-response, type of item or the multiple-choice, or short-answer, forms.

Testing then in the formal structured sense has three marked advantages over the informal process. It is, however, based entirely upon that underlying process. My experience has indicated that if we go back to that basic process whenever we have questions about the application of testing to particular instances, we will find that the questions themselves--and therefore the answers--become much more apparent.

Now I would like to turn to a few of the basic principles of test construction for classroom use. A first principle is that it takes both content and behavior to sensibly define a given testing situation. To be more specific, if I were to state that I was building a test to cover prescription symbols, it might appear on first blush that I had said something meaningful to the audience in this room. Actually, I would have said something with half a dozen different meanings to half a dozen different individuals in this room. In order to clearly define the area of testing, I would have to speak of the behavior or process as well as the content-prescription symbols. In this particular situation it would make quite a difference if I were to say "recognition of prescription symbols"--recognition being the behavior process--or if I were to say "translation of prescription symbols in new situations." In each case I would be dealing with prescription symbols, but the tests and the sample of behavior which I would obtain would be quite different in the one situation from the other.

Again, if I were to say that I was building a test covering "adjusted isotonic and pH solutions," I would create as many different impressions as to what that test might be as there are notions within the audience of the purposes and

goals of treating this subject in a pharmacy course in the first place. There might be those of you who would think of this in a straight knowledge context--at least at one given level of teaching. Certainly most of you would think of the purpose of this content in terms of such behaviors as analysis or synthesis in problem situations. Thus, the first principle of test construction is that we need a two-way matrix or two-dimensional frame within which we place our test purpose or test behavior.

In a course in pharmacy at perhaps the junior level we might have the topic of "use of preservatives." In terms of testing, we might think of the topic in at least three ways: (1) a knowledge (the behavior being recall or recognition) of certain principles in the use of preservatives; (2) a translation behavior in which the individual would decode certain expressions and then through associations encode them into technical language of preservatives; or (3) the application of principles connected with the use of preservatives to new situations which have not been used in the instructional settings. In short, whenever one of us develops an examination over instructional materials in a course, it is important that he describe both the content involved and the behavior he expects with that particular content. In my use of the word behavior, you will note, I have included an expression of knowledge, such as recall or recognition.

A second general principle in test construction and use is that the tests used do affect what is learned. We can test a chemical substance for CP and still have more of the same sample with which to work later. When we test an individual on some specific behavior--such as analysis--with some specific content--such as morphology and anatomy of stems--we have actually affected the individual by the very testing process.

One good example of this principle is that embodied in the following situation. An instructor in discussing volatile oils emphasizes to the class that he is not concerned with their memorization of specific terms and situations but he is concerned with their understanding the material being discussed and being able to use that understanding in solving certain kinds of problems. A week or two weeks later he presents them with an examination in which he asks them to regurgitate certain specific statements which he has made in his lecture or which have appeared in a given textbook. These very students, consciously or unconsciously, soon learn that what he says about his goals and the goals he actually has--that is, the behaviors which on their part really count--present somewhat

of an anomaly. Quite frequently they follow his tests rather than his statements. In the case in question they learn--from the tests--to memorize the facts and not bother about the understanding.

A third principle in test construction is that the scoring criteria are as much a part of the actual test as the items themselves. Too frequently we find individual instructors who ask a series of questions which they call a test and then after obtaining the responses they spend a considerable number of hours marking or grading the papers and perhaps using a different set of criteria on some of the papers than they do others. This procedure most assuredly destroys one of the main advantages of using tests in the first place. If the criteria for scoring do not remain the same, obviously the identical process is not applied to all individuals tested. Control of the stimulus-response-inference process is thereby lost. If scoring procedures and criteria were set up at the time of construction of the test and considered a part of the test, we would probably not run into the expressions of "objective tests" or "essay examinations" as frequently as we do. All of the tests--whether they were short-answer such as multiple-response, true-false, or matching or whether they were what we tend to call free-response, that is, the essay or discussion type--would be more or less objective, depending upon the firmness of the criteria for scoring.

"Shall we grade them on English--that is, grammar and organization--or shall we stick to the subject matter?" This is a question which would be asked less frequently if those responsible for tests followed the first and third principles mentioned. The behaviors to be tested would have been decided upon in making the test matrix of content and behavior. The scoring system would have been based upon the course or curriculum objectives. And, if they were to be graded on grammar, the test directions (stimulus) would have said so.

A fourth principle of testing is a rather obvious one. The total test situation, plus previous instruction, governs the nature of the stimulus as well as the nature of the response. If I were to administer a perfectly legitimate set of test items to a group of students under circumstances which might lead to great tension--such as this must be finished in ten minutes, pass this or you'll have to take the course over, et cetera--the variance in the responses would depend as much upon personality factors as it would upon knowledge or understanding or application of content. This would be fine if I wanted to test for these personality factors. It would be ruinous to predict behavior of understanding, let's say, on the

basis of personality factors.

Please note that I have not said that testing under tension conditions is bad. I have only said that the tension condition becomes part of the total test stimulus and therefore affects the validity of our inference concerning the response. The total situation, not the test item, is actually the test. Previous teaching enters the situation and affects what we call the test. If we have taught individuals a particular laboratory process in a cookbook fashion, we must remember that a test designed to investigate their ability to follow that procedure is not testing problem-solving behavior but is testing sheer memory and perceptual motor integration. On the other hand, if we have taught them principles of the laboratory procedure and then set them in a new situation unfamiliar to them, we may be testing problem-solving behavior in addition to knowledge of principles.

In summary, in construction and administration of classroom tests four principles are extremely important:

1. It takes both content and behavior to define a test.
2. The tests we give affect learning--either positively or negatively.
3. Scoring criteria are part of the test.
4. Previous instruction, test directions, and the testing situation all determine the behavior being tested--they are part of the test.

Now, finally, I would like to turn to some of the devices and practices which are gaining current usage in testing and seem to bear much promise. I rather imagine that most of you have used some of these and perhaps some of you have used all of them. They still bear mentioning in that their usefulness has been proved in many situations.

The first of these is the use of item analysis data on tests which we have given to individuals. The common method is to look at each item in a given test and simply count the number of individuals who have chosen each of the possible answers. It may sound as though I am talking about multiple-choice tests only. It is obvious that this could apply equally well to essay or discussion items if we have specific criteria in scoring. Frequently in this process it is useful to count the number of responses for those who are in the upper 25 per cent on total score on the test and tally separately the number for those who are in the lower 25 per cent. There are nomographs or charts which will allow us to use these data to determine an estimate of correlation between

each item and the total test. This gives us the extent of relationship between the behavior tested in this given item and the general behavior tested throughout the test. It helps answer the question, "Are these items all testing the same behavior?"

These data also allow us to make statements concerning the difficulty of the item. If we are working with a group which we can think of as a reasonable sample of the total population whom we will teach over a period of years, it is possible through item analysis to develop test items for future use which will give the kind of distribution of difficulty which we want. By typing each item on a 3 x 5 card with a notation of content, behavior, difficulty, and relationship to total score, we can build a test file with known items.

A second practice which seems to be gaining in popularity or in usefulness is that of scoring papers which have been coded by number instead of by pupil name. This practice seems to be especially important in grading or marking the free-response, or discussion-type, question. As humans we are quite susceptible to perceiving what we were looking for in the first place. We are more apt to consciously or unconsciously be looking for a certain type of behavior if we have the name of the student attached than if we have an unidentifiable--at the moment--number.

A third practice which bears mentioning is that of sequential testing. A full explanation of this procedure and its possible uses would take more time than we have. The general idea is that instead of taking the time of all individuals to give them all items in a given test category we may proceed on the basis that a few items may discriminate the top students from the bottom students and that additional items will only be necessary for those students about whom we are in doubt of classification. This process of sequentially testing diminishing groups of the class will unquestionably save us time both in testing and in the sometimes laborious process of paper-marking. Sequential testing may be particularly inviting to those who are attempting to carry on the rather time-consuming process of laboratory-performance tests.

A final device which bears mentioning at this point is one which I imagine many of you have tried. It is the "take-home" test. This ordinarily consists of a number of problem-solving situations which are given to the student with complete understanding that he is to use whatever materials are available

to him in terms of textbooks, notes, special devices, and the like. It is only expected that he himself will solve the problem, that is, that he will not seek a solution and copy it from somebody else. Because pressure for grades is frequently high and to err is human, this method of getting samples of behavior should probably not be used as the sole method of evaluating student progress or of grading. It is a useful device for gaining a certain type of information concerning natural problem-solving situations.

In summary, testing consists of a basic process, stimulus-response-inference-prediction set, with which we are all familiar. Tests themselves are samples of behavior. They afford more control and greater speed than the more casual processes of sampling behavior from incidental observation. Tests in subject-matter areas certainly imply behavioral as well as content descriptions. The total test situation, administrative conditions, past training, and test items define the actual stimulus and therefore define the response and the inference. Objectivity comes not from the form of the item, but rather from the clarity of the test description and the criteria and procedures for scoring. The total business of testing also affects learning. By the appropriate use of tests we can improve the students' learning.

#### Summaries of Workshop Sessions

Tuesday, August 9

##### Section A: Teachers of Pharmaceutical Arithmetic

Reported by J. A. Kearns, Rutgers University

We covered a lot of the problems that arise in the teaching of pharmaceutical calculations, but I doubt whether we solved all of them.

One of the first that was mentioned is highly important--the fact that many are attempting to teach pharmaceutical arithmetic or calculations to very large classes. It was generally felt that this is one of the greatest handicaps most teachers have. Although it is recognized that many schools of Pharmacy are under-staffed in all departments, something must be done about more staff if calculations, a very important phase of pharmaceutical education, is to be taught properly.

The next area of discussion included procedures for teaching the course, the use of homework, and daily quizzes. It was pointed out that it was necessary to give the students an understanding of the meaning and use of significant figures. Pharmacy teachers are handicapped in doing this due to the lack of adequate explanations of this topic in pharmacy textbooks.

In discussing examinations, we found that we had quite a divided group, with strong differences of opinion on how examinations should be used. Some thought that if a student fails the final examination in the calculations course, he should fail the course. Others felt that one examination should not determine whether or not a student should fail the course; but rather, the average of the term's work, which might include a number of examinations, should be the determining factor in this decision.

Next, we discussed the matter of how calculations should be offered. There were two recommended methods: One, of giving a separate course in calculations early in the program and then making sure that the subject matter is integrated in the courses in the remainder of the program; and the other method, of not having a separate course at all, but making sure that the calculations course is an integral part of every professional course.

A report was given on a survey conducted in Michigan regarding the amount of calculations used in a number of prescriptions.<sup>1</sup> It was surprising how few calculations were used in these prescriptions, raising the question of just how important is this phase of pharmacy? Is it as important as we think it is? Unfortunately, we did not have the time to go into any discussion of this aspect.

Finally, there was a brief discussion concerning the use of tests to determine ahead of time whether a student would have difficulty or would stand a fairly good chance of passing the course in calculations. It was felt that if some good predictor could be developed, it would be possible to avoid unnecessary failures by requiring remedial arithmetic or something of that nature.

---

<sup>1</sup>Copy of this report may be obtained from F. A. Grolle, University of Michigan, College of Pharmacy.

## Section B: Laboratory Instruction

Reported by E. P. Guth, Ohio State

There is room for improvement of the laboratory instruction in the College of Pharmacy in the 4-year program and this must be done in the 5-year program. In the 4-year program it will take ingenuity, hard work, and patience. Any improvement should be directed toward improving the quality of instruction and to increase the scope of the course. There is tremendous opportunity for integration of the pharmacy laboratory courses with other courses given in the College of Pharmacy and courses given outside the College of Pharmacy. Every effort should be made to bring about integration to improve the other disciplines that are taught in the College of Pharmacy. Special emphasis must be placed upon the quality of instruction in the pharmacy laboratory. We feel that laboratory work is so important that we must have adequately trained individuals in attendance and the proper number of teachers so that we have a good ratio between students and faculty. We made no recommendation as to what that number should be, however, we feel that at the present time there is probably an improper ratio.

We feel that the major professor should make every effort to be in the laboratory and that if he has assistants, that these assistants should not be considered as substitutes for him, but only as an assistant. We recommend the use of laboratory demonstrations and in some instances using them as a means of employing certain techniques.

## Section C: History Teachers

Reported by G. Sonnedecker, U. of Wisconsin

We started with the objectives and found no serious disagreement. It was suggested that we add to the objectives as a subsidiary point, the development in the student of a critical ability to examine the problems of pharmacy, and to develop the ability for a good discussion. Some felt that having special discussion groups would mean gearing down the scope of the course too much. The consensus was that it is well worth experimenting with discussion sections with this objective in mind. Along the same line, the idea was suggested that the subject was too rich and too full to try to sideline it for something else in the curriculum.

Under methods of teaching the course it was brought out that with the advent of the expanded curriculum, perhaps it will be taught in some schools on a higher level because of the introduction of pre-pharmacy. Further, many of the students will be coming in from liberal arts where they will have had some general history. One of the largest areas of agreement was that we should teach it the way we mentioned this morning. If at all possible it should be an upper division course. It was felt that 2 hours was certainly the minimum; three hours seems to be a reasonable allotment for the subject. There were several suggestions that it should be a required course. It was also suggested that fragments of history could be used in the orientation of other pharmacy courses.

Using motion pictures, having the students do outside reading, developing a mimeographed outline for the course, etc. were discussed. The use of book reports and papers was discussed briefly. The suggestion was brought out that possibly an extra credit could be given for supplementary reports and papers prepared. This would give the student an opportunity to get into the library and find detailed information about a topic that was of particular interest to him. Now to do this we would need a good library and would need to instruct the students on the use of the library. Finally, we concluded with a brief discussion of special courses in history of pharmacy, pointing out that some of these could be done by graduate students as special projects.

#### Special notes on Section C Report

1. Two mimeographed brochures designed to be helpful in building library resources at a college and in writing and teaching history of pharmacy were distributed to participants in the workshop. Copies may be obtained by addressing the School of Pharmacy, University of Wisconsin, Madison 6, Wis.

2. Films suitable as general background for topics in a history of pharmacy survey course. Selected by Glenn Sonnedecker and George Osborne.

1. The Story of the Prehistoric Man (Coronet)
2. Ancient Egypt (Coronet)
3. Ancient Mesopotamia (Coronet)
4. Ancient Greece (Coronet)
5. Ancient Rome (Coronet)
6. Mohammedan World: Beginnings and Growth (Coronet)
7. Medieval World (Coronet)
8. Renaissance (Coronet)

9. They Live Again (TFC)
10. Louis Pasteur (Sterling)
11. Colonial Expansion (EBF)
12. Early Settlers of New England (EBF)
13. Territorial Expansion of the United States from 1783-1853 (International)
14. Westward Movement (EBF)
15. Triumph Without Drums (TFC)

3. Several formal statements and outlines were presented by the discussion leaders in this workshop. Information and copies of these materials may be obtained from the participants.

## MORNING PAPERS

WEDNESDAY, AUGUST 10

J. B. Sprowls, Presiding

## PHYSICAL SCIENCES IN RELATION TO PHARMACY

T. Higuchi

U. of Wisconsin

## I. PLACE IN PHARMACEUTICAL CURRICULUM

It is with some hesitation that I approach the problem of the relationship of physical sciences to pharmacy. There appears to be a very definite and growing feeling among certain elements in pharmacy that physical sciences should be gradually de-emphasized as a part of pharmaceutical training. It has been suggested that the pharmaceutical curriculum adopt a new look more in line with current drug store practices and needs.

Thus, for example, Dean Orr at Miami Beach before the Pharmacy Teachers' Conference advocated that since compounding and formulating duties of a retail pharmacist take so little of his time now (and probably even less in the future) our colleges recognize the situation and change our curriculum accordingly. He suggested, if I recall correctly, that greater emphasis should be placed on areas related to pharmacodynamics and therapeutics so that the retail pharmacist can perform his function as a physician's advisor more effectively. I do not wish to argue for or against this point of view today, but it is a factor which must be considered in formulating the physical science part of our curriculum.

The need for physical sciences in pharmacy is inherent in the accepted official definitions of the term pharmacy. Thus according to Webster: "Pharmacy: 1. Art or practice of preparing and preserving drugs, and of compounding and

dispensing medicines. 2. A place where medicines are compounded or dispensed; a drug store; apothecary's shop." Remington: "Pharmacy is the science of medicinal substances. It embraces not only a knowledge of medicines and the art of compounding and dispensing them, but also their identification, selection, preservation, combination, analysis, and standardization."

If pharmacy is defined in this manner, physical sciences, especially chemistry and physics, rather than biological sciences constitute the basis for this profession. In its restricted dictionary sense, courses such as microbiology, physiology, pharmacodynamics, etc., have no part in the pharmaceutical curriculum. I do not intend by these remarks to belittle the importance of these areas in pharmaceutical training but rather to emphasize the basic nature of physical sciences to pharmacy.

## II. NECESSARY COMPONENT OF PHARMACEUTICAL CURRICULUM

Physical sciences, which in the sense used here include mathematics, physics, and chemistry, serve three purposes in our pharmaceutical curriculum: (1) They are the meat of the so-called general education background we try so hard to inculcate into our students. (2) They constitute the only sound basis on which the more applied biological sciences are built. (3) They include all that is science in pharmacy in its classical operational sense.

### A. General Education

In these days of fission and fusion bombs, nuclear powered submarines, solar batteries, and man-made satellites, it has become increasingly imperative that our students be exposed to rudiments of physical sciences. Despite the contention of some to the contrary, the training we give to pharmacy students today is hardly sufficient for them to understand even current news reports dealing with these subjects. Any more time devoted to physical sciences does not compete with general education courses but rather to the contrary. Or from another viewpoint, classical education used to be mathematics, sciences, Greek, Latin, and history of Rome. Since only mathematics and sciences remain of value to us, physical sciences constitute the bulk of classical education of today.

### B. As Basis for Biological Sciences

Science areas which at one time were considered to be entirely separate from physical sciences are now finding their

frontiers restricted largely to people well trained in physical sciences. Both biochemistry and physiological chemistry courses, at least at the University of Wisconsin, have calculus and physical chemistry as prerequisites. Mechanism of muscle contraction, of transmission of nervous signals, of vision, of cellular metabolism and of electrolyte balance require sound background in mathematics, physics and chemistry for their understanding.

This is not a passing phase but a fundamental movement. In the near future it is not unlikely that substantially all investigators in the fields of biological science will be heavily trained initially in the physical sciences.

#### C. In Pharmacy

Pharmaceutical operations are all based on physical sciences. In formulating new drugs, in preparing novel dosage forms, in predicting drug release rates, in preserving preparations against microbiological and chemical deterioration, the pharmacist must fall back on his physical science background. How and where physical sciences are basic to pharmacy is discussed in greater detail in the following section.

To reiterate, courses in physical sciences serve a three-fold purpose in our pharmaceutical curriculum; as a part of general education, as an introduction to the more applied biological sciences, and finally to provide the necessary theoretical bases for pharmacy itself.

### III. PHYSICAL SCIENCE COURSE REQUIREMENTS IN THE PHARMACEUTICAL CURRICULUM

Webster and Blauch list the courses recommended by the Survey. They include 69 credit hours. These are exclusive of electives and general education courses. It is evident that this amount of time, while modest for a six-year program, probably represents the maximum or even more in a five-year schedule.

I have neither the time nor the inclination today to discuss and analyze all the individual courses listed here. Details of each course have been presented and debated on many occasions during the past decade. Rather, I would like to view the whole subject of physical sciences and its relation to pharmacy and see if all that we want and all that we think we need as a foundation for professional pharmacy is covered at least in a minimal way somewhere in this list.

### Mathematics

Mathematics is, basically, the mother of all science. Physics cannot exist without mathematics and chemistry cannot exist without physics. Since physics and chemistry provide the theoretical basis for operational pharmacy, pharmacy, as a science, cannot exist without these supporting areas.

The nature and extent of mathematics requirement for the pharmaceutical curriculum is a very sensitive subject in which the extremes have usually expressed themselves more vocally than the middle-of-the-road advocates. There are those who feel that one year of college math, no matter what the course, is more than sufficient. And there is the group who insist on completion of a year's course in calculus with possibly some statistics thrown in as the minimal requirement. There is always a middle ground. It has always bothered me, personally, that so many deans and other pharmaceutical educators are perfectly willing to have a mathematics requirement through analytical geometry but balk at calculus. It is analogous to building a car and leaving off the tires. Analytical geometry, as such, has no significant applied value other than as an introduction to calculus. Since the geometry course, as such, serves no real purpose, it has increasingly become the practice to combine analytical geometry and beginning calculus into a single course. Such a one-semester course which in many cases can be taken in the freshman year, will satisfy me.

Another possible solution would be to combine the mathematics requirement for physical chemistry with that course. It is my feeling that all the basic calculus, which would be used in pharmacy, can be taught in 15 hours to any intelligent college student having a good background in algebra. It is suggested that the physical chemistry course can be made into a form of a preparatory course for physical pharmacy where the student is provided with the necessary mathematical and physical chemical background. I would like to see this course divided into a lecture and a quiz component with two credit hours each per week. The lecturer will treat that part of classical physical chemistry necessary to prepare the student for physical pharmacy. Mathematical background will be provided in the quiz section. In addition, mathematical problems dealing with physical chemical systems would be dealt with in detail in this class.

### Physics

Physics to the extent described in the table is already

being taught in nearly all schools of pharmacy. Although nothing would make me happier than to have our students exposed to less descriptive, higher level material than is being taught now, I realize that this would be extremely difficult to accomplish and possibly may not do any good.

In physics our students of pharmacy must gain their concepts of units of length and measure, of force and energy, of kinetics and statics, of electricity and heat, among other things. It is in these areas of knowledge, I find graduates of colleges and schools of pharmacy to be particularly deficient. Any strengthening in physics from the present status is certainly desirable.

### Chemistry

Chemistry serves as the immediate foundation for the science of pharmacy. Drugs being chemicals or combinations of chemicals, for a pharmacist to perform in his profession, he must first be a chemist. He must be well grounded both in inorganic and organic chemistry. Physical chemistry must be a part of his background to understand and correct incompatibilities and instabilities, and to formulate heterogeneous preparations. Analytical chemistry is a necessary requirement if he is to continue as the self-appointed custodian of our national drug standards.

On the other hand there is a real danger that in making a pharmacist so much a chemist, we have partly lost sight of our primary reasons for doing so. Although it is of some value for our students to know, for example, how to synthesize chloramphenicol, it is much more important that they know the chemistry of the drug itself. How does it behave in solution of dilute acid? Dilute base? Hot water, cold water? In reducing solution, in oxidizing solution? What are its crystal properties? Solubility properties? These are questions which arise directly from his own professional work. And these are questions which are rarely answered in the pharmaceutical chemistry course. There should be less on synthesis of vitamin A and more on the chemistry of the substance itself.

### IV. NEED IN THE GRADUATE AREA

Because of the diversity of subject matters taken up in the professional undergraduate program, our B. S. graduates find themselves as Jacks-of-all-trades and master of none when they enter graduate schools. Our students are exposed to a series of survey and introductory courses which leave them ill-equipped for advanced research on a level equal to that

in other more basic areas.

The most serious weakness, from my personal observation, lies in the fields of mathematics, physics, and chemistry, i.e. in the physical sciences. I am sure that I reflect the feelings of all graduate teachers in pharmaceutical sciences when I say that students contemplating graduate study in pharmacy should make all efforts to take a two-year physics course, mathematics through calculus and possibly a course in physical chemistry before matriculating.

It is difficult at the present time to foretell the exact effect of the extended curriculum on the graduate area. On one hand, we are strengthening the basic physical science requirements for the first degree; on the other, we are in effect reducing the time which can be practically utilized for graduate education. It is hoped that the advantages will outweigh the disadvantages.

**Discussion:** No discussion of the paper was recorded

#### PHYSICAL PHARMACY

(Theoretical Pharmacy)

Alfred N. Martin

Purdue University

Physical pharmacy was proposed some years ago by the Curriculum Committee of the American Association of Colleges of Pharmacy to treat the principles of pharmacy on a quantitative basis. According to Busse (1) it deals with the physical chemical principles and laws as applied to a study of pharmaceutical systems.

The pharmacist of today more than ever before must demonstrate an understanding of the physical and chemical properties of the medicinal products which he handles; and in order to acquire this knowledge he must borrow heavily from the physical, chemical, biological, and medical sciences. Physical pharmacy lies at the boundary between these various disciplines, and thus may be referred to as an eclectic study.

**Objectives.** The objectives of a course in physical pharmacy include the knowledge, laboratory skills, communication skills, thought processes, and attitudes which the

the student should have acquired at the conclusion of the course. Consequently, the main effort in physical pharmacy at the undergraduate level is directed toward developing in the student the ability to:

- (1) Comprehend the physical and chemical laws which are useful for the solution of pharmaceutical problems and to apply these principles in the formulation of pharmaceutical preparations. The student should also be able to predict the behavior of pharmaceutical systems based on a knowledge of these laws. (Knowledge)
- (2) Understand the scientific framework upon which much of modern pharmacy is based and develop techniques through actual laboratory experimentation and use of research instruments. (Laboratory skills)
- (3) Learn the scientific terminology required for reading, writing, and discussing modern professional and scientific literature. (Communication skills)
- (4) Think logically, yet creatively and imaginatively, in solving problems. Logical thought and creative ability will be considered in a later section. (Thought processes)

Furthermore, the course should provide an atmosphere in which the student may develop new attitudes and judgments. Parts of the course in physical pharmacy can transfer to the student much of the spirit and philosophy of science, and can help him to understand some of the scientists' rights and responsibilities during these times and for the future.

Scope of the Course. Physical pharmacy draws the threads of fact and theory, knowledge and skills of the physical and biological sciences into an integrated whole, and relates them to practical pharmacy. At the teachers' seminar on pharmaceutical chemistry, Dr. Higuchi said that physical pharmacy "...is a fundamental course offering the firmest base on which to build all modern upper level professional courses in pharmacy." (2)

Physical pharmacy also contributes through research to the fields of manufacturing, hospital, and retail pharmacy. Some of these applications are enumerated as follows:

#### I. Pharmaceutical Industry

A. Research. Fundamental research in solubility, colloidal phenomena, and the properties of drugs with relation to their action on living cells.

- B. Development and Formulation. Application to the preparation of new dosage forms.
- C. Production. Application of physical chemical principles to the unit operations of liquid flow, heat transfer, emulsification, tableting, and filling and packaging of pharmaceutical preparations.
- D. Packaging and Storage. Use of kinetic studies in determining the rate of product deterioration and in estimating the storage life of the drug.
- E. Control. Development and improvement of physical methods of drug analysis.

II. Biological and Medical Research.

- A. Study of Vehicles and Drugs with Relation to Medical Applications. Wetting, spreading, and flow properties of vehicles, diffusion from dermatological bases, site of disintegration and rate of absorption of drugs from solid dosage forms.
- B. Physics and Chemistry of Drug Action. Kinetic treatment of metabolite antagonism; the Ferguson principle and thermodynamics of non-specific inhibition.

III. Professional Pharmacy

- A. Hospital Practice. Adjustment of pH and tonicity of ophthalmic, nasal, and parenteral preparations; the use of preservatives and effect of sterilization techniques on the stability of drugs; formulation of new vehicles.
- B. Retail Practice. Application of fundamental principles in predicting and solving incompatibilities; preparation of isotonic buffered prescriptions; the proper use of suspending agents, masking agents, and other pharmaceutical adjuncts.

Some may be skeptical of the role of physical pharmacy in the border regions listed above. But nature knows no separate disciplines of mathematics, physics, chemistry, biology, and a scientist should not become alarmed when he finds that the knowledge of his area is spilling over into the next; particularly in these times of mathematical biophysics, physical biochemistry, and human engineering.

The greatest misgivings will probably arise with regard to the role of physical pharmacy in the study of drug action--the accepted province of the pharmacologist and pharmaceutical chemist. Therefore, I want to describe briefly how the physical

pharmacist is assisting in this complex and difficult area of investigation; and I shall use the Ferguson principle as an example.

It has been recognized for many years by workers in this field that the action of most narcotics, analgesics, and other structurally nonspecific drugs is related to a more fundamental quantity than the concentration of the drugs in a homologous series. However, it was not explained in a precise way until Ferguson (3) in 1939 stated the principle that approximately the same biological effect occurs at the same thermodynamic activity rather than at the same concentration of homologous drugs.

Allawala and Riegelman (4) applied the Ferguson principle to show that the thermodynamic activity at which various phenols produce an equal degree of antibacterial action is approximately the same. The rule should also be applicable to a wide range of structurally nonspecific antiseptics, preservatives, and insecticides. Thus, we see the usefulness of physical biochemical principles in the study of drug action.

#### THE UNDERGRADUATE COURSE

The undergraduate course in physical pharmacy should constitute three lectures and one three-hour laboratory period per week for one semester. If pharmaceutical technology is combined with physical pharmacy, as suggested in a later section, the course might be extended to two semesters.

Prerequisites. Physical pharmacy is designed primarily for the junior or senior pharmacy student who, having completed the basic science and mathematics courses, is in a position to apply this knowledge to the practical science of pharmacy. The student should have completed the courses in physics, pharmaceutical preparations, organic chemistry, qualitative analysis, and at least one semester of quantitative analysis. The undergraduate course outline here does not presuppose a background of calculus and physical chemistry.

Course Outline and Schedule. A brief outline of the lecture and laboratory topics for a one-semester course is given here. More detailed outlines of several lecture presentations and laboratory experiments are included in Appendixes A and B.

## Section I. Fundamental Principles

Week	Lectures		Laboratory
I.	Introduction, Definition, measurements, theory of errors, graphical representation of data.	Exp. 1.	Sensitivity of the pharmacy balance, precision and accuracy in weighing and measuring. (See Appendix B for details of one such experiment.)
II.	Structure of Drugs and States of Matter.	Exp. 2.	Physical properties of gases, liquids, and solids. Melting and boiling point determinations, refractometry polarimetry.

## Section II. Pharmaceutical Solutions

III.	General Principles of Solutions. Definitions, classification, properties of solutions of electrolytes and nonelectrolytes.	Exp. 3.	Preparation of buffers for use in later experiments.
IV.	Solutions of Electrolytes. Ionic equilibria, pH, buffer solutions. (See Appendix A for a detailed outline.)	Exp. 4.	Continuation of previous work and colorimetric determination of pH.
V.	Colligative Properties of Solutions. Calculations and methods for preparing isotonic solutions.	Exp. 5.	Preparation and testing of isotonic buffered solutions. Blood cell method for determining tonicity. Freezing point determinations.
VI.	Phase Equilibria and Solubility. A study of solvent-solute interactions, theory of dissolution, effect of pH on solubility, and the distribution of drugs and adjuncts between phases.	Exp. 6.	Influence of the solvent on drug solubility. The effect of pH on solubility of weak electrolytes. Distribution studies and the effectiveness of preservatives. Preparation of phase diagrams from solubility data. (See Appendix B for details of several such experiments.)

## Section III. Pharmaceutical Dispersions

VII. Colloidal and Interfacial Phenomena. A study of the physical and chemical properties of colloids including surface active agents. Exp. 7.

VIII. Micromeritics. The physics and chemistry of powders and solid dosage forms. Exp. 8.

IX. Rheological Properties of Pharmaceutical Systems. A discussion of the theory and pharmaceutical applications of rheology. Exp. 9.

X. Emulsions. Classification, theory of formation and stabilization, study of properties and uses of emulsifying agents, and methods of preparation. Exp. 10.

XI. Suspensions. (A detailed outline of this topic is found in Appendix A.) Exp. 11.

XII. Semisolids. Gels and other disperse systems of a semisolid nature. Exp. 12.

Adsorption of drugs by alumina, charcoal, clays. Wetting tests. The use of solubilizing agents in pharmaceutical preparations. Particle size measurements. True and apparent density of powders. Deliquescent and efflorescent powders. Eutectic mixtures in prescriptions. Rate of disintegration and absorption of solid dosage forms. Use of rheological instruments and methods. Viscometer, tackmeter, gelometer, etc.

Methods of preparation. Use of mixed emulsifiers and HLB determination. Phase volume ratio and inversion. Microscopic examination. Relationship of factors in Stokes' law to creaming. Stability and breaking of emulsions. Sedimentation rate and particle size. Sedimentation volume and flocculation. Wetting and deflocculating agents in pharmaceutical lotions. Rheological properties of suspensions. (See Appendix B for a representative experiment.) Microscopic examination and rheological tests on gelatinous precipitates and pharmaceutical jellies. Levigating agents,

humectants, plasticizers and other adjuncts for pharmaceutical semisolids. Physical chemical properties of ointments, pastes, and suppositories in relation to administration and release of medication.

#### Section IV. Advanced Topics (Optional)

- XIII. Decomposition Kinetics and Drug Stabilization. Experiments in the deterioration of hydrogen peroxide and the inversion of sucrose may be carried out.
- XIV. Electrical Properties of Solutions. The experimental part may involve the application of conductometric titration to the assay of penicillin, the assay of phenobarbital by potentiometric titration, and the determination of pH by the electrometric method.
- XV. Physics and Chemistry of Drug Action. Experimental studies on the rate of drug release from bases and the penetration into the skin may be demonstrated.

Lectures The students should be provided with a study guide and laboratory manual from which weekly reading and problem assignments are made. The lecture periods are devoted to explaining difficult aspects of the topics, and to working representative problems corresponding to the homework assignments. The student's homework is corrected and returned each week. Some examples of questions and problems are included in Appendix C.

The student's interest may be maintained in the classroom by relating theory to practical drug store and manufacturing problems whenever possible. Actual prescriptions which actually exemplify the principles under discussion are brought to class by the students and teacher. These are copied on the blackboard and discussed by the group. If the students show particular interest in one of these prescriptions, several persons may be assigned to improving the product in the laboratory period and reporting back to the group. In this way, classroom "theory" and laboratory practice are closely integrated.

Laboratory. The students are assembled for a thirty-minute

discussion period before each laboratory session. The laboratory experiments are discussed by the instructor and students, and various methods of approach are considered.

Each week, three students are assigned to abstract pertinent reports from recent pharmaceutical literature; and during the latter part of the pre-laboratory briefing, they deliver the reports before the class.

The experiments are designed so that, for the most part, only simple apparatus commonly available in the pharmacy laboratory are employed. Special instruments are discussed in the appropriate lectures and their applications to pharmacy are demonstrated by the teacher in the classroom and laboratory.

Each student uses a notebook for recording experimental procedures and data and submits his results in report form at the completion of the experiments. Several typical experiments are found in Appendix B of this report.

The laboratory work should be designed not only to teach techniques, but also to encourage logical and creative thought. Whereas the student in his first and second year of college should concentrate on preparing pharmaceutical products conforming to an accepted standard of elegance, in the upper-level courses he should rely more on his own judgment and should practice new approaches to the solution of pharmaceutical problems. Thus, as the student matures intellectually, he changes from the imitator to the creative worker; and the teacher should provide the changing educational atmosphere needed to challenge the student constantly as he progresses.

But can creative ability be taught in the university? Maurice Nelles (5), director of oceanographic research at Borg-Warner, says that "such a precious thing as creativity, whether it be in the arts, pure science, or profitable inventiveness, is too important to be left to accidentally fortuitous circumstances." A. F. Osborn of BBD&O thinks that creativeness can and must be taught in the sciences and professions; and he has organized and endowed the Creative Foundation to promote the study of creative thinking. General Electric Company recognizes that imaginative thinking "pays off" and now offers a Creative Engineering Program, the first course of its kind in industry. Professor Arnold of Massachusetts Institute of Technology teaches a required course in Creative Imagination to seniors and graduate students in mechanical engineering. One of the problems which the students must confront involves an imaginary planet inhabited by three-eyed bird-like creatures. The gravity of this strange world is eleven times that of the

earth, the atmosphere is methane, the oceans are liquid ammonia, and the temperature ranges from -122 to -230 degrees. The students are required to design products to improve the living standards of these creatures.

One of the functions of our teachers' seminars is to bring before the group new teaching techniques which cultivate creative qualities in the students. Certainly our pharmaceutical manufactures need more young men and women with creative abilities, and medical science is in need of fresh approaches to the problems of cancer, heart disease, arthritis, and many others. In the discussion period this morning, you might care to suggest how creative thinking could be developed to a greater extent in the student through better teaching methods.

#### A PROPOSED GRADUATE CURRICULUM IN PHYSICAL PHARMACY

In order to complete this kaleidoscopic view it is necessary to refer briefly to the graduate program in physical pharmacy. Subjects suitable for the major are listed.

Intermediate Physical Pharmacy.....	3 credits
Physical Pharmacy - Disperse Systems.....	3
Physical Pharmacy - Kinetics.....	3
Experimental Physical Pharmacy.....	4
Physical and Colloid Chemistry.....	10
Seminar.....	2

Because of the diversified applications of physical pharmacy in research and industry, no specific minor fields are indicated. In order to provide a firm background, however, some of the following subjects should be taken by all students majoring in physical pharmacy:

Advanced Organic Chemistry (Reaction Mechanisms or Physical Organic) ..	3 or 6
Biochemistry.....	6
Advanced Pharmaceutical Chemistry.....	3
Advanced Pharmaceutical Analysis.....	3
Advanced Calculus or Differential Equations....	3
Statistics.....	3

For the purpose of discussion, the minor subjects may be divided into two groups: courses for students specializing in industrial research, product development, and production; and those for students specializing in drug-action studies.

The students who are interested in the first area would choose courses in:

Product Formulation.....	2
Advanced Pharmaceutical Production.....	3 or 6
Chemical Engineering: Unit Operations...	3 or 6

while students specializing in the action of drugs may elect courses from the following list:

Chemotherapy.....	2
Pharmacology.....	4 or 8
Microbiology (chemistry and physics of... microorganisms)	4
Biophysics .....	3 or 6

#### OBSERVATIONS AND CONCLUSIONS

After acquiring some experience in teaching physical pharmacy and exchanging ideas with others who are interested in this area, I have come to some tentative conclusions.

1. Although the student will no doubt be introduced to physical chemical principles in many courses during his college education, these fundamentals as applied to the practice of pharmacy should be brought together in a separate upper-level course in the third or fourth year, or in the fifth year of the extended program. The course seems to be particularly well placed when it bridges the gap between pharmaceutical preparations and the compounding and dispensing courses: at this point it best accomplishes the objectives that were outlined at the beginning of this report. Physical pharmacy should not precede the course in analytical chemistry in order that quantitative analytical methods may be practiced.

2. Blauch and Webster (6) recommend calculus and statistics, and a six-credit course in physical chemistry preliminary to physical pharmacy so as to systematically correlate "the observations, methods, techniques, and thinking of mathematics, physics, and chemistry." In the five-year curriculum of some of the schools it may be possible and desirable to precede physical pharmacy with these courses.

However, I have found that students are often mystified by the abstract concepts of physical chemistry as generally taught, and some are overwhelmed by the difficulties of the course. Consequently, they resort to rote memorization, and the course fails to provide the "enlightened understanding" which Blauch and Webster intended for it. I have been discouraged by the lack of expected physical-chemical maturity in some students who have entered physical pharmacy with a background of calculus and physical chemistry. Professor Clark of

Johns Hopkins University School of Medicine makes a similar point when he refers to the "lapses into which even an excellent student will fall when spurred beyond his natural pace." (7)

An alternative involves inverting the suggested order so that all undergraduate pharmacy students take physical pharmacy without having previously had calculus and physical chemistry. Students who intend to enter graduate school and who are interested in the advanced theoretical aspects of pharmacy may then take calculus and a good course in physical chemistry. According to this plan elementary physical pharmacy helps the students to acquire that seamanship in placid, chartered waters that will contribute to their handling of craft on troubled seas, as Professor Clark would state it.

3. I would like to suggest modification of another proposal in The Pharmaceutical Curriculum. If pitched on an intermediate level as suggested above, physical pharmacy may well be united with pharmaceutical technology to form a single two-semester course. Some schools may choose to refer to it by a title other than physical pharmacy, but regardless of the terminology the course can provide a synthesis which is more "practical" from the student's viewpoint.

#### REFERENCES

1. Busse, L. W., Amer. J. Pharm. Ed., 15, 66, 1951.
2. Higuchi, T., Proc. Teachers' Seminar on Pharm. Chem., July 1952, p. 102.
3. Ferguson, J., Proc. Roy. Soc. Lond. B., 127, 387, 1939.
4. Allawala and Riegelman, J. Amer. Pharm. Asso., Sci. Ed., 43, 93. 1954.
5. Nelles, M., Chem. Eng. News, 31, 1518, 1953.
6. Blauch, L. E., and Webster, G. L., The Pharmaceutical Curriculum, American Council on Education, Washington, D.C., 1952.
7. Clark, W. Mansfield, Topics in Physical Chemistry, ed. 2 The Williams and Wilkins Company, Baltimore, 1952.

## APPENDIX A

## LECTURE OUTLINES

<u>Ionic Equilibria</u>	<u>Suspensions</u>
I. Introduction to Equilibria	I. Introduction
II. The Law of Mass Action	A. Definition
A. Equilibrium Expressions	B. Classification
1. Dissociation of a weak acid	Properties of Suspensions
2. Dissociation of a weak base	A. Interfacial Properties
3. Degree of dissociation	B. Electrical Properties
4. Polybasic acids	C. Rheological Properties
5. Amphoteric electrolytes	D. Administration Properties
III. Ionization Constants for Weakly Acidic and Basic Drugs	III. Stabilization of Suspensions
IV. The Ionization of Water	A. Suspending Agents
V. Sorensen's pH Scale	1. Surfactants
A. The Role of pH in Pharmacy	2. Deflocculating agents
B. Calculations	3. Hydrophilic colloids
1. Hydrogen ion concentration to pH.	B. Theory of Sedimentation
2. pH to hydrogen ion concentration.	1. Stokes' law
C. pH of Weak Acids and Bases	2. Sedimentation vs. Brownian motion
VI. Hydrolytic Equilibrium	3. Sedimentation volume and clay formation
A. Salts of Weak Acids and Strong Bases	IV. Preparation of Suspensions
B. Salts of Strong Acids and Weak Bases	A. Wetting and Dispersing of Powders
C. Salts of Weak Acids and Weak Bases	B. Principles of Machinery used for Dispersing Particles in Liquid Vehicles
VII. Buffer Solutions	V. Survey of Recent Investigations
A. The Buffer Equation for a Weak Acid and its Salt	
B. The Buffer Equation for a Weak Base and its Salt	
C. Buffer Capacity	
D. Buffer Systems in Pharmacy	
E. Colorimetric Determination of pH	

## APPENDIX B

## REPRESENTATIVE LABORATORY EXPERIMENTS

Experiment 6.3: Prepare the following solutions

Sulfathiazole Sodium 5%  
 Buffered Diluting  
 Solution, q.s. ad 1 fl. oz.

Calculate the pH above which the solution must be maintained to prevent precipitation of the drug, and formulate a buffer for the solution. Calculate the tonicity of the finished product. Add several drops of defibrinated blood cell suspension (see exp. 5.5) to a small quantity of the solution and observe under the microscope to verify your calculations.

Experiment 6.4: Using the appropriate data at hand, prepare the following prescriptions and adjust them to form stable and, where possible, clear solutions. Hand in the adjusted products, properly labeled, together with the complete report.

Rx (1) For Mr. J. J. Harkins  
 Phenobarbital.....gr. vi  
 Compound Digestive Elixir, q.s....fl.oz. i  
 M. ft. a clear solution  
 Sig: 5 ml. at bedtime  
 Dr. Jones

The student is taught to proceed somewhat as follows. The elixir contains 18% of alcohol and 25% glycerin by volume (cf. N. F.). To dissolve 6 grains of phenobarbital (1.33%) in such a vehicle requires about 27 to 30% alcohol in the solvent, as found in Fig. 1. Since the elixir already contains 18% alcohol, 9 to 12% additional (about 1 fl. dram of U.S.P. alcohol) is needed. This quantity of alcohol is mixed with the drug and the solution is brought to 1 fluid ounce with the elixir. A clear solution results.

Rx (3) For Mrs. J. C. Hall  
 Phenobarbital Sodium.....gr. 12  
 Sodium Bromide.....dram i  
 Digitalis Tincture.....fl. dr. iii  
 Thiamine HCl Elixir, q.s.....fl. oz. ii  
 M. ft. a solution.  
 Sig: One tsp. t.i.d. 1/2 hr. a.c.  
 Dr. Clark

How would you suggest that the student fill this one?

Experiment 8.1: Divided dosage powders are prepared in

prescription practice by one of several methods: (a) weigh each dosage and place on separate powders; (b) block and divide the powder and transfer each segment to a paper; and (c) distribute the powder by visual estimation. Prepare the following prescription by method (b) and (c):

Rx for Betty Jacobs  
 Sodium citrate.....3.0  
 Magnesium oxide, heavy  
 Charcoal, aa.....2.0  
 M. ft. chartulæ #vi.  
 Sig: One in water 1/2 hr. p. c.

Fold the papers and place in a labeled powder box. After the prescription has been checked by the instructor, carefully remove the powder from each paper and weigh accurately. Determine the arithmetic mean weight and the standard deviation for the powders. Report the accuracy in terms of the percent error of the arithmetic mean from the absolute or true weight of the powder contents. In the light of these results, compare your compounding skill by use of the two methods.

Experiment 11.2: Gravitational sedimentation is based on Stokes' law. The law is useful for estimating the size of particles in the range of about 0.5 to 100 microns. Prepare 100 ml. of a 3% aqueous suspension of zinc oxide, place in a 100 ml. cylindrical graduate, agitate the mixture, and then allow the particles to settle. Measure the height of the clear zone ( $h$ ) from time to time and plot  $h$  in cm. against time in sec. Determine the velocity of sedimentation from the slope of the line. Calculate the effective diameter,  $d_e$  of the particles using the equation,

$$d_e = \sqrt{\frac{18 n}{(p' - p) g}} \cdot V$$

#### APPENDIX C

#### REPRESENTATIVE QUESTIONS AND PROBLEMS IN PHYSICAL PHARMACY

1. Assuming that the sensitivity of your balance is 3 mg., describe how you would fill a prescription calling for 12 tablet triturates of atropine sulfate, each containing 1/500 gr.
2. Describe the method for preparing this prescription using the Sprowls Method.

Rx Methamphetamine Hydrochloride, 1% V = 10 ml.  
M. ft. 60 ml. of an isotonic buffered (pH 6.8) solution.

3. Using the Sodium Chloride Equivalent Method, calculate the quantity of NaCl needed to render the following prescription isotonic:
 

Neo-Synephrine HCl.....	0.3 Gm. E = 0.29
Chlorobutanol.....	0.2 Gm. E = 0.18
Distilled water, q.s. ad.....	60 ml.
4. If morphine alkaloid (molecular weight 285) has a per cent colubility of 0.02, what is the approximate weight in grams of morphine sulfate (molecular weight 760) that can be dissolved in 100 ml. of buffered solution at pH 6.0? The  $pK_b$  for morphine is 6.13.
5. What ratio of sodium borate and boric acid is required to prepare a buffer solution with a pH of 9.0? The  $pK_a$  of boric acid is 9.24.
6. Using Stokes' law, calculate the rate of sedimentation in cm./sec. of a sample of zinc oxide, with an effective radius of 1 micron and a true density of 5.5 Gm./cm.<sup>3</sup> suspended in a vehicle with a density of 1.1 and viscosity of 5 poises (dyne sec./cm.<sup>2</sup>).
7. A sample of chloroform rose to a height of 3.67 cm. at 20° in a capillary tube having an inside radius of 0.01 cm. What is the surface tension of chloroform at this temperature? The density of chloroform is 1.476 Gm./cm.<sup>3</sup>. Assume that the contact angle between the liquid and the capillary wall is insignificant.
8. If the surface tension of water is 72.8 dyne/cm. at 20°, the surface tension of benzene is 28.9, and the interfacial tension between the two liquids is 35.0, what is the work of cohesion of the organic liquid, the work of adhesion between water and benzene, and the spreading coefficient of benzene on water?
9. Discuss the application of spreading coefficient data to the formulation of a pharmaceutical lotion and to the development of an insecticidal spray.
10. How does the hydrophilic-lipophilic character of a compound influence its adsorption at interfaces? Sketch the adsorbed layer of oleic acid molecules at the interface between mineral oil and water.

11. Describe the possible mechanisms of action of solubilizing agent. Enumerate the difficulties that may arise in the use of sorbitans as solubilizers and explain how each objection may be corrected or eliminated.
12. Describe the method suggested by Husa and Becker for preventing liquefaction of capsule ingredients. What method is suggested by Bellafiore? Discuss eutectic formation between salol (m. p. 42<sup>8</sup>) and camphor (m. p. 180<sup>0</sup>) and sketch the phase diagram for this pair.
13. How does the apparent viscosity of a suspending agent affect the stability of a pharmaceutical suspension? Why cannot "one-point" viscometers be used for measuring the viscosity of non-Newtonian suspending agents? How does thixotropy affect the suspending action of an agent?
14. If olive oil is dispersed in water to form globules with a total surface area of  $1 \times 10^7 \text{ cm.}^2$ , and the interfacial tension is reduced to 2 ergs/ cm.<sup>2</sup> by an emulsifying agent, what is the increase in total free surface energy in calories?
15. Discuss the influence of the following factors in the preparation of a vegetable oil-lime water emulsion: (a) acid value of the oil, (b) phase volume ratio, (c) strength of the calcium hydroxide solution, and (c) phase inversion.
16. A sample of white petrolatum was analyzed in a Stormer viscometer and the following data were collected:  $W = 1800 \text{ Gm.}$ ,  $W_f = 1420 \text{ Gm.}$ , rpm = 500, and  $K_y = 50$ . What is the plastic viscosity in poises of this sample? Of what value is a knowledge of rheology in ointment formulation?
17. Describe the preparation of an oil-in-water ointment base which is isohydric with the acid mantle of the skin. What effects do washing soaps have on the acid mantle?
18. A solution of a drug contained 500 units per ml. when prepared. It was analyzed after a storage period of 40 days and was found to contain 300 units per ml. Assuming the deterioration is first order, at what time will the drug have decomposed to one-half its original concentration?
19. List the characteristics of the container and closure which may influence the stability of a drug product?
20. Discuss the stability factor which must be considered in

formulating a parenteral product that is to be packaged in multiple dosage vials and shipped by air to the tropic zone.

Discussion: No pertinent discussion of the paper was recorded.

#### AN OVERVIEW OF PHARMACEUTICAL TECHNOLOGY COURSES

Edward J. Rowe

Butler University

By the course title "Pharmaceutical Technology", we are referring here to the course in sequence and content recommended in the Pharmaceutical Curriculum by Blauch and Webster. That is, a five-semester hour course which follows Pharmaceutical Preparations and precedes Dispensing.

The student before he takes this course will have had Pharmaceutical Calculations, Pharmaceutical Preparations, and Physical Pharmacy.

By way of review, the content for Pharmaceutical Technology as recommended includes:

1. Solid dosage forms (compacted and noncompacted)
2. Semi-solid preparations (ointments and ointment-like preparations)
3. Dispersion of solid and liquid substances (suspensions, emulsions)
4. Solutions
5. Parenteral and related preparations
6. Flavoring, coloring, and masking agents
7. Preservation and storage

Moreover, the student with his background courses and from the manner in which the above units in total are covered, should have gained

- (1) an "increased familiarity with, and integration of, scientific knowledge and skills...";
- (2) a "comprehension of other scientific principles applicable to the production of pharmaceuticals";
- (3) an "increased facility in the techniques used in producing more effective medicinal products";
- (4) an "appreciation for, and realization of the importance of, pharmaceutical elegance in preparations and prescriptions, together with familiarity with the agents and methods to attain this result";

- (5) "ingenuity and creative thinking in the application of basic knowledge and pharmaceutical skills to
  - (a) the compounding of prescriptions,
  - (b) product formulation for retail or hospital level manufacturing, and
  - (c) the advising of physicians on the formulation of extemporaneous prescriptions, and
- (6) appreciation for, and realization of the need for a high degree of pharmaceutical skill and a high level of professional competence in pharmaceutical practice.

An examination of a goodly number of the latest catalogues indicates that course titles are not necessarily descriptive of course content. In other words, identical titles are not descriptive of identical courses. However, I should like to make the following observations:

1. A few colleges have already begun to offer a pharmaceutical technology course with its prerequisite of physical pharmacy.
2. A few colleges offer a separate course in one or more of the units called for as, e.g., "Parenteral Solutions" or a course in "Emulsions and Dermatological preparations."
3. Most of the colleges offer a course which precedes Dispensing under such titles as:
  - General Pharmacy II
  - Advanced Theoretical Pharmacy
  - Advanced Techniques
  - Intermediate Pharmacy
  - Dispensing
  - Theory and Practice of Compounding
  - Pharmaceutical Preparations II
  - Theory and Applied Pharmacy
  - Operative Pharmacy
  - and others.

The colleges offering these courses do not list a physical pharmacy course as such.

I should assume, then, that the material recommended for Pharmaceutical Technology in Blauch and Webster for the most part, at present, is being approached in an integrated manner.

It is not always an easy task for colleges to hurriedly change curriculums. Rather the changes come about gradually. We here at Butler are in the same position as a number of you. We do not, as yet, have a separate course in Physical Pharmacy. Our approach to the Pharmaceutical Technology in Blauch and Webster is through our course which precedes Dispensing and

which we call Pharmacy Preparations II. In order to hear something from others, and in anticipation of the workshop this afternoon, I should like to take time for just one of the units of our course, and present to you the approach currently used. The unit is "Ointment and Ointment-like Preparations, Emulsions and Suspensions." It covers about 7 weeks.

On the two mimeographed sheets distributed to you, you have a familiar skeleton outline, essentially of chemical groups. Needless to say, the substances used to make the ointment and ointment-like preparations, emulsions and suspensions, peculiarly admit of this type of grouping. Teaching from such an outline, obviously involves correlation and integration, not only on the part of the teacher, but also on the part of the student.

By way of introducing the students to the subject of Ointment and Ointment-like Preparations, Emulsions and Suspensions, the point is made and elaborated that properties of compounds are functions of their structure, and that the properties of compounds are going to be a guide in formulations and techniques. Hence the approach to the unit under the heading of II, Surface Active Agents in Pharmacy.

### Lecture

- I. Introduction
- II. Surface Active Agents in Pharmacy
  - A. Anionic, cationic, nonionic  
Chemical nature; water-soluble groups; oil-solubilizing groups.
  - B. Fixed oils and fats as sources  
Chemical constituents, saturated, unsaturated, type structures; role in ointments, suspensions, emulsions.
  - C. Surface tension, interfacial tension  
Adsorption, film formation; significance.
  - D. Emulsification, detergency, wetting, foaming  
Factors to be considered and their significance-- density, particle size, Stokes Law, viscosity, stability; essential and advantageous qualities of emulsifying agents from a pharmaceutical point of view.
  - E. Relationships of emulsions, suspensions, colloids
  - F. Micelle formation and significance  
Occurrence in pharmaceutical preparations.
  - G. Classification of pharmaceutical preparations with reference to surface active agents

## 1. Anionic

## a. Soaps - "conventional"

(1) Characteristics, incompatibilities, monovalent, polyvalent, type emulsions formed.

(2) Functions and contributions of mono- and polyvalent soaps in official and nonofficial preparations.

(a) Liniments, ointments, pastes, suppositories.

(b) "Conventional" cold and vanishing creams.

## b. Soaps "Newer"

(1) Hydroxy alkylamines - ethanolamines mono,

(a) di, tri; Advantages and disadvantages in emulsions, creams; chemical reaction involved; fitness for pharmaceutical purposes; use in official and nonofficial preparations.

(2) Sulfated compounds

(a) Same type of treatment as for alkyl amines. Introduction of washable bases and their advantages and disadvantages. Use in official and nonofficial preparations.

(3) Sulfonated compounds

Same type of treatment as for sulfated compounds. Suitability for specific applications.

(4) Varieties of anionic "newer" soaps; availability; illustrated areas of applications.

## c. Overview of other anionics

Mimeographed tabulation showing different chemical types, trade names, composition, marketed forms.

## 2. Nonionics

a. Characteristics, types, comparative advantages

b. Use and function in official and non-official preparations.

(1) Polyhydroxy alcohol esters and ethers

(a) Glycerol stearates, mono, di, tri; fixed oils.

(b) Polyethylene glycols, esters, ethers.

(c) Uses and applications in, and preparations of creams, lotions, suppositories, emulsions, prescription compounding.

(2) Availability, versatility

(3) Overview of other nonionics--similar treatment as under anionics.

3. Cationics

a. Characteristics, limitations

b. Scope of use

c. Official and nonofficial preparations

d. Overview of other cationics

(Similar treatment as under C. Anionics.)

III. Dispersion Stabilizers, Other Emulsifiers

A. Distinction from surface active agents above

B. Alcohols, esters

1. Acyclic

a. Lauryl, cetyl, stearyl, oleyl, spermaceti  
Chemical relationships; functions in creams, lotions, ointments, suppositories. Illustrations.

b. Polyethylene glycols, carbowaxes.

Types, designations, properties, advantages, scope of use--official and nonofficial preparations. Water soluble bases.

2. Cyclic

a. Cholesterol, wool fat.

Characteristic properties. Absorption bases.

Specific applications of absorption bases.

Proprietaries.

C. Carbohydrates

1. Natural

Tragacanth, Agar, Chondrus, Pectin, Starch

2. Derived

Algin, methylcellulose, S.C.M.C.

Chemical relationships as a group; properties; contributions to emulsions, suspensions, pastes, jellies; official and nonofficial jellies and pastes.

D. Proteins

1. Gelatin - Pharmagel A, B.

Significance in emulsions, suppositories, glycerogelatins; incompatibilities.

E. Finely divided inorganic solids

Bentonite, Veegum, silica (silicones are brought in at this time for the present) in lotions, pastes, ointments, suspensions. Magnesium and aluminum hydroxide are mentioned but only secondary to use as emulsifying agents.

## IV. Hydrocarbons

A. Official petrolatum

B. Functions in official preparations

Type Library Assignments

1. Look up (1) five different proprietaries using cold cream bases and (2) five using vanishing cream bases. Ascertain, if possible from the medicament (s) contained therein the nature of the base used. Cite your references.
2. What washable bases and absorption bases are available commercially for prescription use? What are the claims made for their advantages? Cite your references.
3. Under what brand names are the following available: S.C.M.C., methylcellulose, S.L.S., Stearyl alcohol?

Laboratory

## Type experiments:

1. Demonstration of Surface tension measurements  
Interfacial tension measurements  
Viscosity measurements  
Particle size  
Stokes Law
2. Preparation of cold and vanishing creams and evaluating them on the basis of incompatibility with typical prescriptions. Class is divided. Some prepare the conventional creams, some use the "newer" anionics and some the nonionics. A summary period is held toward the end of the laboratory session.
3. Preparation of water-soluble bases  
(Hydrophilic ointment, Beeler base, Gibson base) and evaluation from a compatibility standpoint. Class is divided into groups, each group preparing a different base. A summary period is held toward the end of the laboratory session.
4. Solubilization experiments using Spans and Tweens as means of solving prescription incompatibilities.
5. Preparation of jellies and gelatin suppositories, carbowax suppositories theobroma oil suppositories.
6. Evaluation of suspensions, bentonite, methylcellulose,

tragacanth with indiffusible solids such as aspirin and acetanilid. Compare sedimentation, viscosity, stability.

Kaolin mixture with pectin - substitute suspending agents and compare.

Students are assigned experiments for the given laboratory period one week in advance, together with pertinent references.

Before beginning the laboratory work, the student is expected to have secured in a notebook information relative to:

- Procedure, with an understanding of each step.
- Synonyms or trade names, if any, nature and source of each ingredient and its function in the preparation.
- Intent of the finished product and its mode of use
- Applications of the preparation in other pharmaceuticals, if any.
- Special storage requirements, if any.

The student is evaluated on the basis of:

- Accuracy.
- Handling of materials and equipment.
- Neatness and quality of preparations.
- Conduct in laboratory, attitude.
- Notebook contents, neatness, quality
- Examinations.

Discussion: No pertinent comments were recorded.

#### PROFESSIONAL ELECTIVES

Tom D. Rowe

University of Michigan

In preparing this paper, it was surprising to find that very little has been written on this subject. Blauch and Webster devote the last part of their chapter on Pharmacy courses to "Elective Courses" and a few other authors make more or less passing reference to this field. Other than these instances, Professional Electives as a group have received little attention. There are a number of articles about particular courses, and reams have been written about the need for general education electives. Perhaps in our desires to broaden the pharmacy curriculum and include more courses in humanities and social sciences, we have overlooked the possible need and place for professional elective subjects.

A discussion of professional electives seems especially pertinent at this time when the colleges are making preparations for the extended program. Perhaps more use of them will be made in the five-year course than has been the case in the past. Certainly a limited use has been made of these subjects in the present four-year program. A study of the catalogs of 64 of the schools on the four-year program shows that 23 of them have no provisions for electives of any type. Forty-one or approximately two-thirds of those studied have provisions for elective courses which could include professional electives. It is not possible to ascertain from all of the catalogs whether or not professional electives actually are given or if the time allotted is devoted exclusively to general education courses. It appears that in most of the 41 cases, professional electives can be included. The figure of 2/3 of schools having some provision for professional electives does not seem too bad, but that figure alone does not tell all of the story. The total number of hours allowed for electives (both general education and professional) in the 41 schools having them is as follows:

Less than 5 semester hours	6 schools
From 5-9 semester hours	14 schools
From 10-14 semester hours	12 schools
From 15-20 semester hours	6 schools
21 and above	3 schools

It can be seen that twenty of the 41 schools have 9 semester hours or less allotted for all electives. Usually the majority of these hours are devoted to courses in general education. Consequently, the time available for professional electives in these 20 schools seldom exceeds 3 semester hours or one course. If we include with this group the 23 schools which have no provision for professional electives, we have a total of 43 or two-thirds of the schools studied which have provision for two or more courses.

To me the significant point of these figures on the lack of appreciable amounts of professional electives, indicates that for the most part, our graduates are all being turned out in the same mould. This statement is no revelation because it is rather generally accepted that 80 to 90 percent of the graduates go into retail pharmacy and are so trained. What about the 10 to 20% that do not select this field? In at least 2/3 of our schools they have little if any choice for special training in some other branch of pharmacy. Perhaps if more opportunities were available in the schools for the students to learn something about areas other than retail pharmacy the 80 to 90% figure would decrease. Certainly in the years to come hospital pharmacy, manufacturing pharmacy

and other areas will be attracting more of our graduates. We in the colleges should be making plans to train these people. This specialized training can be accomplished by greater use of professional electives.

Except for one reason, to be pointed out later, it is hard to understand why more schools have not made use of optional curricula. This arrangement, even in the four-year program, is a way of permitting students to study in the field they believe they will be interested in. It also affords a means of offering more professional electives.

Of the 64 schools studied, only 11 offer optional curricula. Six others have partial options. Nearly all of the schools could make use of this device. I say nearly all because some schools will find it difficult if not impossible to offer much in the way of professional electives with the present size of their faculties. A school with not more than four or five full-time faculty members will be hard pressed to offer professional electives and not overload the teaching staff. This is a danger that many schools face and may be the main reason for the limited number of optional curricula and professional electives. Actually, some schools now offering a number of professional electives are doing so only by overloading their staff. For example, one school has a full-time staff of four, including the dean. This group teaches all of the courses in pharmacy, pharmaceutical chemistry, pharmacognosy, and pharmacology. A total of 31 undergraduate courses are offered and 14 additional graduate courses are listed. A grand total of 45 different courses are given by the four men or 11 courses per person each year. The total number of hours offered in these courses is 143 semester hours, exclusive of credit in research. Thus, each man is responsible for teaching 18 hours per term plus directing research and advising whatever graduate students he may have. Possibly some of the courses listed are not given each year, but no indication to this effect is made in the catalog. This particular case is probably the extreme in all of the colleges, but it is not unusual for one or more men in a number of schools to be listed as teaching 20 or more semester hours each term. In many cases they actually do teach this number.

These situations are obviously unfair to the teachers and students. Professional electives should not be offered to such an extent that the faculty is unable to do them justice. If schools do expand in this field, additional staff will be needed in many cases.

If the curricula of the schools now offering five-year

programs are an indication of what is to come, professional electives will play an increasingly important role in the future. Although only three of the seven five-year schools in continental United States offer optional curricula, all of them have some provision for professional electives. Two of them allow for only 6 semester hours in this area, but the remaining 5 provide for considerably more.

Ohio State University, the first school to require a five-year program, has perhaps gone further in the matter of professional electives than any other school. This has been done by making extensive use of optional curricula. The school has what amounts to a core curriculum for all students. In the last two years provision is made for 21 quarter hours (14 semester hours) of electives. The student may select any one of six fields of specialization. Perhaps only a few schools will want to or be able to go as far as has Ohio State. It would seem possible for many of the schools to offer three or four optional curricula with their attendant professional electives.

It should be pointed out that all of the elective hours provided for at Ohio State are not in the five major pharmacy areas - pharmacy, pharmaceutical chemistry, pharmacognosy, pharmacology, and pharmacy administration. These areas are included but in addition courses in Chemical Engineering, Chemistry, Botany, Mathematics, Physiology, Anatomy, Bacteriology, and Zoology are listed in one or more of the six fields of specialization as set up in the catalog.

These courses at Ohio State are not listed as professional electives, but as electives. They are in addition to 20 quarter hours of subjects in humanities and social sciences and 10 quarter hours in general education electives provided for in the 2 pre-pharmacy years. They are obviously intended to be part of the specialized training in a given field, but are they to be classified as professional electives? Actually, it makes little difference how they are classified, but for the purpose of mutual understanding in this paper, I believe there should be some definition or description of what I mean when the term "Professional Elective" is used. Unless otherwise specified, I should like to use it to mean any course in the five major areas not listed as a required subject in the curricula proposed by Blauch and Webster. This description can lead to some confusion because a required course in some schools may be an elective in Blauch and Webster's curricula. Veterinary pharmacy is a good example of this situation. It's a suggested elective in Blauch and Webster. The majority of schools which offer it do so on an

elective basis. Yet a half dozen or so include it as a required course in their curricula. This confusion cannot be avoided but if we all have a general understanding of the meaning of the term as used in this paper, I'm sure the confusion can be kept to a minimum.

Having defined the term, it would seem advisable to take a look at some of the courses being offered as professional electives. Referring again to the 64 four-year schools whose catalogs were studied, it was found that five courses were offered much more frequently than any of the others. A tabulation of these courses is presented below:

33 schools offer courses in Special Problems  
33 schools offer courses in Hospital Pharmacy  
30 schools offer courses in Manufacturing Pharmacy  
24 schools offer courses in Veterinary Pharmacy  
23 schools offer courses in Cosmetics

After these, there is a big drop in the number of schools in which other courses are offered. The next highest is a course in Insecticides which is given in 12 schools. These figures and all others used in this paper refer to the undergraduate program only. No explanation of the names used for the courses seems to be necessary except for manufacturing pharmacy. In some schools this term is used for the course generally named Pharmaceutical Preparations. Therefore, less than 30 of the schools are actually offering courses in manufacturing pharmacy.

There is a wide variety of other courses offered but in most instances only two or three schools give them. Among these are: Ethics, Professional Relations, Sick Room Supplies, Parenteral Solutions, Show Card Writing and Window Display, and Glassblowing. Two interesting side-lights noted were, (1) five schools require registration in a course entitled "Pharmacy Inspection Trip" (no credit); (2) 19 of the 64 schools do not require Drug Assay.

The five courses included in the list of those most frequently offered were not especially revealing. Except for the actual number of times offered probably all of you in this audience would have been able to guess at least four of the five courses as included in the list. What rather surprised me was the relatively few courses offered in Ethics. Only three schools offered this as a separate subject. Some offered Ethics as a part of the course entitled "History and Ethics of Pharmacy". Even so the total number of schools offering a course with the word Ethics someplace in the title was quite small. I was surprised at this result because of the great amount that has been published about the need for this subject.

We do not offer it as a separate course at Michigan, and I thought we were in the minority group of sinners. Perhaps it was some consolation to learn that we had considerable company in this omission.

It can be seen from the partial list of courses offered, including those now given in only a few schools, that a wide choice of professional electives is available. Inasmuch as this Seminar is devoted to Teachers in Pharmacy, I have listed only those subjects included in Pharmacy proper. However, in arriving at the overall figures, all professional electives were considered. There are electives offered in all of the other areas but none of them are offered as many times as the first five named.

In the seven five-year programs studied, the overall picture for the specific electives offered is much the same as that for the 64 four-year programs. The same five courses are the ones most frequently listed. The tabulation is as follows:

7 (or 100%)	offer courses in Manufacturing Pharmacy
6	offer courses in Special Problems
5	offer courses in Hospital Pharmacy
4	offer courses in Cosmetics
4	offer courses in Veterinary Pharmacy

A course in Insecticides is offered by four schools on the five-year program so this subject on the extended program enlarges the list of five most frequently offered to six. The one school on the six-year program includes all six of these either as required or elective courses in its curriculum.

It is not possible from catalog information to properly evaluate the various courses which are offered as professional electives. No doubt many of them are excellent courses, well planned and well taught, while some of them are possibly poorly presented and poorly organized. Brief general remarks about a few of them can be made.

Blauch and Webster, in "THE PHARMACEUTICAL CURRICULUM", have a good presentation on manufacturing pharmacy as a professional elective. They bring out several important points but do not mention the expense involved. They state "All colleges of pharmacy should be encouraged to develop such a course and to acquire the necessary staff and facilities as soon as possible." I am in agreement with this statement if the colleges considering such a course realize that this subject probably requires a greater expenditure of funds than does any course in the pharmacy curriculum.

In order to equip a manufacturing pharmacy laboratory with the bare minimum of equipment needed at least \$10,000 would have to be expended. This amount would not allow for any equipment required for work in the preparation of parenteral solutions. To go beyond the most basic and elementary presentation of this course, an additional \$10,000 worth of equipment is needed and this sum would not begin to provide all of the extras desired.

This course requires a separate laboratory with special electrical wiring, special plumbing, and special type work spaces. These additional expenses, plus salaries for qualified teachers, must all be carefully considered before undertaking this course. The laboratory space required is generally more than planned on. I would suggest that the total amount of square feet thought to be adequate be determined and this number then be quadrupled. Otherwise, the laboratory will be entirely inadequate within a year or two of operation.

While I believe this course is one of the most important professional electives which can be given, many schools in view of other pressing needs may find it advisable to postpone its inauguration. There are today some schools giving the course without adequate equipment and facilities. It would be unfortunate if more schools entered into this category.

One of the other professional elective subjects I should like to mention is hospital pharmacy. This topic, too, is on tomorrow's program, so I will limit my remarks. You will recall that earlier in this paper I stated that 33 of the 64 schools on the four-year program, 5 of the 7 on the five-year, and the one school on the six-year program, a total of 39 of the 72 schools studied, offered courses in hospital pharmacy. More schools are offering undergraduate courses in this field than in any other of the professional elective subjects. Obviously a great interest already exists in this area. It will certainly increase in the years to come.

Blauch and Webster state:

"In addition to the fact that a number of graduates in Pharmacy will serve in hospitals, there is another reason why attention should be given to instruction in hospital pharmacy - it emphasizes pharmacy as a health service and extends its professional aspects. For this reason the colleges may well look forward to the day when all their students will have some instruction in this field and some first hand experience with it."

Before the time arrives when all pharmacy students will

be taking some work in hospital pharmacy, a great deal of work must be done on course outlines and material for beginning undergraduate courses in this field. Again, quoting from Blauch and Webster:

"From a study of the descriptive statements in the catalogs it appears that there is considerable confusion and no general agreement among colleges as to the purpose of a course in hospital pharmacy. In numerous instances the courses include a great deal of compounding and dispensing. Certainly compounding and dispensing are an important part of a hospital pharmacy service, just as they are of pharmacy service generally but it would appear that emphasis in a course in this field should be upon development of hospitals, their place in society, the importance and place of pharmacy in hospitals, the administrative and policy-making aspects of the pharmacy departments, and the relationships of the pharmacy to the many other components of the hospital. To incorporate in the course large elements of compounding and dispensing is likely to place emphasis on routine manipulative procedures and to result in only cursory treatment of the broader demands and aspects of pharmaceutical service in hospitals."

Faculties should study closely the report of the Special Committee on Education of the American Society of Hospital Pharmacists to help bring order out of the confusion which still reigns in this area. A study of the catalogs today, three years after the publication by Blauch and Webster, shows this confusion and lack of agreement to still be existent. I hope the schools now offering an introductory undergraduate course and those which will offer it in the future, will be guided by Blauch and Webster and make this course the type it should be and not one in specialized compounding and dispensing. The May-June, 1955, edition of the BULLETIN OF THE AMERICAN SOCIETY OF HOSPITAL PHARMACISTS has a number of excellent articles on courses in Hospital Pharmacy that should be carefully read by all schools interested in this field.

The other subjects listed as possible professional electives should be carefully studied as to their objectives, course content, and methods of presentation before being started. Only by careful consideration of these factors and others can we make certain that courses of high collegiate caliber are being presented. These courses will come mainly in the fourth and fifth years of the extended program. Probably the majority of them will be in the fifth year. Consequently, they must be courses of high quality if they are to

retain a place of respect in the curriculum.

If this were a meeting of the American Association of Colleges of Pharmacy or some formalized organization, a resolution concerning the establishment of a committee on Professional Electives would no doubt be in order at this point. Being a body with no official responsibilities this gathering will be spared that task. Seriously, though, it would seem advisable for the A. A. C. P. to have some group making a continuous and extensive study of this field of professional electives.

Before concluding, one more aspect of professional electives should be discussed. That is their relationship to elective courses in social sciences and humanities. Can professional electives be given without decreasing the number of hours available for general education electives? If not, should the majority of the hours available be given to the professional or non-professional courses?

Professional electives can be given without affecting the amount of general education electives if optional curricula are used. One of the advantages of the options is that they allow for more flexibility. Thus, a student who elects, for example, an option in hospital pharmacy in preference to the curriculum in retail pharmacy need not be required to take all of the same pharmacy courses as the student in the retail option. For example, the student in hospital pharmacy could be permitted to omit most of the courses in pharmacy administration. In place of these he could take a sequence of courses designed for hospital pharmacy. The general education electives in both curricula would remain the same.

In cases where optional curricula are not used, professional electives can be offered only at the expense of general education courses or some other courses in the curriculum. In such cases I believe the emphasis should be placed on the general education courses. They should be given priority and the amount of professional electives a student could take would have to be kept at a low figure. If in a single curriculum without options a total of 25 semester hours of elective credits were available, I believe that at least 20 of them should be required in general education. The remaining 5 could be in professional electives. I believe the students should have an opportunity to elect some professional courses. Courses in social sciences and humanities are, however, too important to be sidetracked for additional courses in science. One of the main reasons for extending the course to five years is to permit the inclusion of these broadening subjects.

Professional electives should not be used to defeat that objective. If in planning a curriculum the faculty concludes that only 12 or 15 elective hours can be included, then all of this time should be in general education.

In those cases where only 5 or 6 hours of professional electives can be included, I believe the student should have the privilege of electing non-professional courses if he so desires. He should not be required as is sometimes the case now, to take professional electives when his work in general education has been limited already to 16 or 20 hours or less.

The ideal situation would be to design a curriculum which would permit an adequate amount of general education courses plus a sufficient amount of professional electives. In the five-year programs now in operation this has been done in most cases, but not in all of them. The schools now working on their five-year programs should have this ideal situation as one of their objectives.

#### SUMMARY AND CONCLUSION

We have attempted to show that there is a definite place in the pharmacy curriculum for professional electives. They have not, however, received adequate consideration to date. The offerings are limited and over 1/3 of the schools on the four-year program have no professional electives. Another third have provision for perhaps one course. The five-year schools are stronger in this respect. All of them have provision for two or more courses. It has been shown by greater use of optional curricula more professional electives can be included. It is hoped this phase of curriculum arrangement will be given close study by schools now planning their extended program.

In considering professional electives, the size of the faculty should be kept constantly in mind. Professional electives should not be included in a curriculum to such an extent the teachers are badly overloaded and unable to do their courses justice. After all these subjects should be on a high level and of special benefit to the student.

Of the formal elective courses offered, excluding special problems, manufacturing pharmacy and hospital pharmacy are the ones given in the largest number of schools. Both of these courses have particular problems which should be studied carefully before the subjects are included in the curriculum.

The relative importance of general education electives

and professional electives was discussed. It is the opinion of this writer that general education electives should have priority over professional courses in case both of them cannot be included. The ideal situation is to design a curriculum which will permit for maximum amounts of both types of electives.

Even though professional electives are not now used as extensively as they could be, rapid progress in their use is being made. Although the catalogs of 10 or 20 years ago were not studied in this report, I am certain that would have shown a much different picture than obtained from today's catalogs. The number of schools offering professional electives 10 or 20 years ago would probably have been less than half of the number today. The various courses given would also have been much smaller. It is to be hoped that a study of the catalogs 10 years from now will reveal that all of the colleges are offering a number of professional electives and that they all have sufficient faculty members to do justice to these important subjects.

Discussion: No floor discussion of this paper was recorded.

#### Summary of Workshops

August 10

##### Section A: Teachers of Professional Electives

Reported by T. D. Rowe

U. of Michigan

We had a very profitable discussion in the section on professional electives. I think our main idea was to stimulate some thinking in that field rather than try to accomplish anything specific. One thing that should be noted is that few of us know very much about professional electives. We feel that a great deal has yet to be learned about them.

We started out by setting up the objectives for professional electives which we formulated as follows: (1) Through providing the background to make the student an individual, in order that he may furnish better pharmacy services. (2) Stimulate the student to develop his total abilities and interests. (3) Stimulate the members of the faculty to develop the areas of instruction in which they have special interest and ability. (4) Utilize more completely existing facilities

for pharmaceutical education. (5) Increase the flexibility of the program in pharmaceutical education. (6) Assist the students in making selections of their areas of specialization.

After discussing objectives we went into a number of courses. There seems to be a need for Veterinary Pharmacy, especially in the rural areas. Often there are interprofessional relation problems. Veterinarians in some areas don't like to see the pharmacist learn anything about the field and much care must be taken. It seemed that 1 or 2 schools had developed courses in cooperation with the veterinarians and in that way, overcame professional rivalry. This problem can be overcome to a certain extent by calling the course by a different name--Animal Health Pharmacy.

We talked about a course in Cosmetics. The feeling of the group was that such a course is of little value and should not be in the pharmacy curriculum. It was felt that such a course might be included if taught more from the physiological standpoint, giving some of the basic information about cosmetics. This was one place where there was almost unanimous agreement. We discussed other courses but time will not permit me to go into those. In conclusion we felt that we should all try to teach professional electives, and that we should try to have an adequate staff as to size and ability.

#### Section B: Physical Pharmacy Teachers

Reported by A. N. Martin

Purdue University

We divided our group up into three sub-groups. Each of our three discussion leaders took one of these groups. I think it worked out quite well. The first group discussed the general plan and the scope of physical pharmacy. The opinions were varied. Many felt that the course material in physical pharmacy was covered in other courses. Some felt that the material should be withdrawn from the present courses in dispensing, preparations, technology, and set up in a separate course in physical pharmacy. Some believed that this course would not remove content from other subjects, but would enable the presentation of theoretical material in a more quantitative manner. Others felt that this was a graduate level course and should not be given in the undergraduate sequence.

The second group discussed the contents and teaching methods of the undergraduate program. They had the feeling

that the course should come in the third year of the present four-year program or in the fourth year of the extended program, or possibly not until the graduate level. As far as the usefulness of this material to the retail pharmacist was concerned, many of them felt that this material was directly applicable to the practices of the retail pharmacist if it was presented in a practical pattern.

The third group had mixed feelings about the term physical pharmacy. Possibly the term "Theoretical Pharmacy" could be introduced. This term seems to describe the contents of the course. No set curriculum was thought desirable for the graduate course in physical pharmacy; rather there should be certain prerequisites that all graduate students should be urged or required to take in order to prepare them for this type of graduate program. Instead of a set curriculum, we should have a battery of courses from which the student could choose depending on his inclinations and background. More mathematics was believed to be needed. This group was in agreement as to the level and type of organic courses that should be taken by these people: the mechanism course, and the physical organic course. It was felt that this graduate program in physical pharmacy does not overlap the courses given in chemistry and physics. This was mentioned in anticipation of the criticism which may come from other departments. There is a definite need for pulling out this information and applying it to pharmaceutical situations in the graduate program. The choice of the background and research that the student wants to do should be very flexible. The research projects should be of a basic nature rather than applied product development or manufacturing. This underlying agreement that seemed to evolve out of the groups was brought out in the closing moments of our session. The apparent confusion is not to be looked upon as discouragement at this time. Confusion is the beginning of progress. A textbook in this area will certainly tend to result in crystallization. In the latter part of the period, we became somewhat philosophical and we touched upon the question of integration of the entire pharmacy course sequence.

#### Section C: Teachers of Pharmaceutical Technology

Reported by E. J. Rowe

Butler University

The pharmaceutical technology workshop opened with short formal presentations by each of the discussion leaders, Dr. Bingenheimer, Dr. Lloyd, and Dr. Osborne.

It was brought out early in the discussion that pharmaceutical technology workshops should be combined with the physical pharmacy workshops in future meetings of this type.

It was not agreed just what was meant by pharmaceutical technology.

The point was made that pharmacy students lack ingenuity and creative thinking and that the subject matter called for in Blauch and Webster was a means of stimulating the development of these characteristics.

The following items were discussed as a means of stimulating ingenuity and creative thinking:

1. Exchange of laboratory experiment ideas among teachers of the course. It was felt that this could well be a project for the Pharmacy Teachers' Conferences of the A.A.C.P.
2. Group projects and individual projects in the laboratory.
3. Laboratory term reports.
4. Theoretical paper exercises.

In the course of the discussion of the above item there was a good exchange of ideas.

#### MORNING PAPERS

THURSDAY, AUGUST 11

T. C. Daniels, Presiding

#### THE DISPENSING PHARMACY COURSE

Charles V. Netz

U. of Minnesota

The course in Dispensing Pharmacy has been characterized as the terminal or capstone course in the pharmaceutical curriculum. It is the culmination of training received to that point and it continues to involve material in additional courses taught concurrently in the senior year. It may be

repetitious in part but repetition within reason, if time permits, is an effective teaching approach.

At one of the Teachers' Conferences, Guth stated, "A course in Dispensing Pharmacy is...not primarily intended to give a student new information but it is intended to show the student how to use and correlate the basic information gained in other courses. This function of correlation and coordination must be done so as to make the student's education meaningful and practical." I am sure we are in general agreement with this statement. It indicated a change from the classical approach, which was concerned largely with preparing and dispensing various types of preparations or mixtures thereof, years in which preparations of vegetable drugs abounded and in which there were only a few organic chemotherapeutic agents available.

At the last pharmacy teachers' seminar in 1949, Brodie said of this period: "The pharmacist was looked upon solely as one skilled in the arts and details of pharmaceutical procedures and the course in Dispensing Pharmacy was designed to meet these empirical needs." He further pointed out the desirability of a pharmaceutical curriculum which would bring professional poise and autonomy to the pharmacist, a curriculum ending with a course in Dispensing Pharmacy which would forcefully climax previous instruction and at the same time include training in the arts, skills, techniques and mechanics vital to dispensing medication on prescription.

At this point I should mention that my discussion this morning will not deal with objectives or subject material or course content except as it is necessary to emphasize teaching methods. In the pharmaceutical literature of the past 20 years there are many excellent articles and reports covering these fields including lists of objectives.

As we all know, a course in Dispensing Pharmacy emphasizes "lecture" and "laboratory" instruction. Let us examine the "lecture" area. In my opinion the formal lecture is the basic component of any combination of teaching methods. The organization of material should be orderly so the student later may fit into it unrelated facts and information brought out in discussion periods and laboratory work. Lectures should provide a basis for orderly thinking as the student progresses in the course.

For years the classical approach was a series of formal lectures upon which were based routine prescriptions compounded in the laboratory by every student. The pattern was much like

that usually followed in pharmaceutical preparations courses in which lectures consist largely of material to be memorized and of laboratory work done "cook book" style. There was little need for a student to go through deductive mental processes to achieve a satisfactory grade. (Please understand these statements are not intended as criticism of preparations courses taught in this way.)

One factor which expanded lecture time was the tendency to leave consideration of certain groups of preparations and dosage forms to the Dispensing Pharmacy course rather than to include them in the preparations course, or, if the material WAS taught in the preparations course, some of it was again presented in the Dispensing Pharmacy course as a review. This was done either because of tradition as carried through in the Pharmaceutical Syllabus or by mutual agreement of teachers in the two courses. At a conference of Pharmacy Teachers in 1946, Ohmart called attention to this inconsistency in the Syllabus and recommended strongly that it be corrected.

Another factor affecting the lecture time in Dispensing Pharmacy was the limited preparation of students in physical, biological, mathematical and other sciences, which made it necessary to include some of this material in the professional lectures. With the advent of the prepharmacy requirement and lengthened course, students are given this material in fundamental courses to a greater extent and more thoroughly than it was ever given in professional courses. Thus there is offered an opportunity for extensive revision of both lecture and laboratory content of many of the professional courses. With respect to the Dispensing Pharmacy course, it makes available time which can be used for a revised lecture and laboratory pattern embracing a scrambling of prescriptions, a pattern resembling routine prescription work in the retail pharmacy. It can force deductive reasoning by the student in which he must either rely on facts learned in and retained from prerequisite courses, or he must review his lecture notes in these courses.

It is obvious that some if not much of the present lecture material must be retained in modified form. The ointment group can be used as an example. There are appearing regularly new ointment base materials which require special compounding knowledge and techniques not required in official ointment formulations. They should have at least superficial consideration in the Dispensing course and I believe this is best done first in formal lecture rather than in recitation or discussion periods. Knowledge gained in disucssion periods

often remains unordered and confused unless the student has had presented to him a logical pattern into which it can be inserted.

Eye medication is another example. We all know it requires special treatment in the Dispensing course. In earlier days it was necessary to devote time to explaining osmotic pressure, pH, and preservatives and to applying them to the work. Now the teacher can assume fundamental knowledge and proceed immediately to its application.

The subject of incompatibilities affects every phase of the course and especially liquids and powders. In my opinion, there is no substitute for the formal lecture in this area. Strength can be added by interspersed discussion periods, or the periods can follow the series of formal lectures.

The classical approach to teaching physical incompatibilities of inorganic compounds is to discuss or review the solubilities of representative salts of the cations and draw group comparisons of the effect of the anions on solubility. For example, certain salts of sodium, potassium and ammonium are mentioned as generally water-soluble whereas the anions of these salts, in combination with certain other cations, give water-insoluble salts. Chemical incompatibilities are considered on the basis of individual cations and anions. Obviously this requires considerable memory work or recall of information from preceding courses, with no analytical thinking by the student.

A second, more scientific, approach, made possible by inclusion of physical chemical courses in lengthened curricula, embraces polarity of solvents and solutes, molecular and ionic forces, and other factors to explain solubility and chemical activity in solution. It also considers the various metals and salts in groups based upon the periodic table of the elements, thereby correlating Dispensing Pharmacy with an earlier study of inorganic qualitative analysis.

The second scheme requires more prerequisite courses than the first but it reduces lecture time and definitely requires deductive reasoning in addition to memory work. At the moment, I have no opinion as to the effectiveness of either approach in turning out competent graduates. Certainly, the second one should give a more versatile pharmacist who can solve problems above the ordinary level of complexity. I suppose, also, that training received in such a course is of value to those few graduates who continue in advanced fields of study or who affiliate with pharmaceutical

manufacturers, specifically in the field of product development.

Organic incompatibilities have increased in number since the early twenties. Aside from typical acid-base reactions (particularly with alkaloids and barbitals), the teaching approach was an unsystematic consideration of physical-chemical properties of the individual compounds, mostly rote memory. In the past 30 years there has been a tremendous increase in the number of organic compounds and a nearly corresponding increase in the accompanying problems of the pharmacist. I say "nearly" because many of the newer drugs were and are prescribed in solid dosage forms which present no dispensing problem.

A later approach to a more systematic consideration of organic incompatibilities was suggested by Sprowls in 1942, when he discussed the use of functional groups to anticipate certain physical and chemical incompatibilities. This concept has been extended materially since then and it is now used by a number of teachers. The student must have a sound foundation in elementary organic and physical chemistries. No matter what plan or combination of plans is used, time must still be allowed to consider unusual properties of some compounds. An example is oxidation of phenols in general to intensely colored decomposition products. Many students are not aware that other components of a prescription mixture containing phenol (hydroxybenzene) may have in them traces of oxidizing substances, often as allowable impurities, and they fail to anticipate the slow formation of color, especially in dry mixtures. We usually spend a few minutes on phenol as such and discuss a number of illustrative troublesome prescriptions.

In summary, the introduction of physical-chemical principles into general inorganic chemistry courses and, later, into pharmacy curricula as a separate course, has enabled many teachers to use a more scientific approach to incompatibilities and prescription compounding in general--an approach which better prepares the student to anticipate what may happen and why, rather than to learn a mass of specific data about a large number of compounds.

Another teaching device is the use of classroom sessions called variously recitation or question and answer periods, prescription forums, and prescription clinics. I will refer to them as recitation periods. In the more effective type the number of students is limited and the teacher is alert to see that a few students (usually the better ones) do not monopolize the time. The recitation period gives opportunity for a more leisurely review of lecture principles and for

application of these principles to a variety of prescriptions. There can also be coordination between recitation periods and laboratory work.

A number of plans are in use. A group of prescriptions is presented in the classroom and various students are asked to discuss one or more. Or the prescriptions may be assigned in advance so the student has an opportunity to study them before classroom discussion. This second method often results in the "loafers" imposing upon the industrious students to do most of the advance reading. The prescriptions can be mimeographed, written or projected on the screen. If mimeographed material is used the prescriptions can be presented in a block. In face of present restrictions pharmacists do not care to release original prescriptions so if experience in reading written prescriptions is desired the teacher must make faithful copies from the originals or the originals must be put on slides. The opaque projector can be used if the store owner is willing to release the prescriptions for a short time.

At the Conference of Pharmacy Teachers in 1946 Sprowls discussed a "prescription forum" approach involving both classroom and laboratory instruction. Prescriptions compounded as written and in corrected form were discussed by individual students before the entire class. Only one student received a given prescription.

The recitation plan offers opportunity to consider more prescriptions than does the lecture-laboratory scheme alone. The teacher can learn more conclusively of the ability of individual students to solve a variety of prescriptions in a pattern simulating professional practice. Grading of students during recitation periods spurs them to more regular study.

The laboratory portion of the Dispensing Pharmacy course must translate the lecture material into conditions of actual professional practice in good retail pharmacies. In addition it should continue to train in previously learned skills, techniques and manipulative practices as well as in new ones such as writing labels, affixing the label to the container, and protecting the label from soil when in the customer's hands. Correct handling of the spatula, use of balances, transfer of weights, holding graduates and pouring from containers should be natural for a polished pharmacist. Some students become skillful because of natural aptitudes, others through conscientious effort and still others through constant urging from the instructors. And of course, some never

respond. Instillation of good habits requires intensive and persistent teaching and supervision, especially of the small number of students who regard instruction with skepticism. Once instructions are given, the laboratory staff must give constant attention to students who unknowingly or willfully fail to heed them.

Some of the skills mentioned above contribute to accurate work, a most vital phase of prescription compounding. Balancing of powder papers before each weighing operation, judging the swing of the balance pointer, and careful reading of the liquid volumes are a part of this picture.

We proceed to methods used for laboratory teaching. There are a number of excellent detailed articles which indicate that the authors are in general agreement on objectives and subject material but that there is some difference in methods of approach. It is probable that a stereotyped set of prescriptions compounded by all students following lecture directions falls short of giving diversified experience such as encountered in actual practice. Under this plan related prescriptions, i.e. for capsules, emulsions, eye solutions, etc., are compounded in groups much as syrups, tinctures, etc. are considered and prepared in the preparations course. A more interesting approach for all except the lazy students is use of a block of differing (scattered) prescriptions assigned for each laboratory period. Assignment can be made at the opening of each laboratory period or in advance, so the student can do book work outside of laboratory time. However, if duplicate prescriptions are involved, advance assignment can lead to exploitation of the better students by the less industrious in order to avoid work. I believe a better approach is to assign prescriptions at the beginning of each period, allow the students to use their own notes and reference texts, and then do the laboratory work under strict supervision of an adequate and qualified staff.

It is obvious that some progress must be made in lecture work before a variety of prescriptions can be used in any one laboratory period. I have heard some teachers state that a prescription is used with only one student each year. To do this requires a large number of soundly formulated prescriptions. The mechanics of cataloging, assigning, and finally checking the compounded prescriptions under this plan requires a competent staff of unusual size.

I find that student interest is aroused by prescriptions common to the immediate area even if such prescriptions are quite simple. Furthermore one finds prescriptions with rather

unusual problems which do not fit into any incompatibility pattern commonly used. In Minnesota such prescriptions originate in certain clinics in the larger cities and many of them reach pharmacists in rural areas. Examples are the insoluble aminophylline-phenobarbital complex in liquid vehicle and the troublesome foam which can result in preparing Hammond's (Black) Mixture. Another prescription credited to a cardiologist in Minneapolis is rather common.

Rx Phenobarbitali Sodici	0.75
Calcii Bromidi	15
Tincturae Hyoscyami	10
Syrupi Glycyrrhizae q. s.	
ad	90

Sig.: 2cc in water p.c. and 4cc h.s.

The dose of Gelsemium Tincture at bedtime is considerably greater than the "usual" dose and the extractive material from the tinctures separates as a flocculent precipitate. Actually it is best dispensed as written, using the mixed tinctures to dissolve the salts. However, from time to time it is reported that a pharmacist meeting this prescription for the first time had done one or more of the following: (1) refused to fill it because of an overdose of Gelsemium Tincture, (2) added a suspending agent which made pouring impossible, and (3) used excessive water to dissolve the salts which resulted in rapid settling of insoluble components. There are also many variations of a "tar oil" formula which cause trouble.

In this category in each geographical area there are probably twenty or more prescriptions which every graduate may soon encounter. In fact some seniors working in pharmacies report receiving such prescriptions and for them it brings renewed interest in the course because of a feeling that the professor is certainly presenting timely material.

Experience with "count and pour" prescriptions is a necessity. The student should be impressed with the importance of using containers of proper size and construction. Manufacturers will usually provide a reasonable stock of specialities which can be housed on shelves and in cabinets in the laboratory to simulate conditions in practice. At some schools one student section fills the prescriptions and another section returns the medication to the shelf containers. This conserves the supply of drugs and gives the second section contact with various specialties. The process is reversed for the two sections with another batch of prescriptions. By handling the specialties the student has an opportunity to learn color, shape, size, action and composition of the more common products.

Earlier I mentioned some factors which affect accuracy in

prescription work. It is a trite statement to say that we believe accuracy is a fundamental requisite. Other factors of equal or greater importance are represented by use of correct ingredients and accurate quantities. There are various approaches which enable the student to check himself or which allow for checking by another student (in actual practice, another pharmacist.) They will probably be discussed in the workshop session this afternoon.

We require a final check for identity and quantity of all ingredients by a member of the staff who may also question the student about compounding approach as well as chemistry, dosage, medical use, etc. of the various ingredients. After compounding, the prescription is brought to a loge for inspection by one of the professors. The student may again be asked relevant questions after which the compounded prescription is accepted, recompounded, or returned for student to keep until he reviews notes and literature for answers to certain questions. We use claim checks and require wrapping only until it is evident that proficiency is satisfactory.

Practice in receiving telephoned prescriptions varies with the number of telephones and the attitude of the teacher. With a sufficient number of phones it is integrated with actual laboratory but for training per se two or three instruments located at a special station can be used continuously with the students receiving the prescriptions, and calling back the prescriber if necessary, but not actually compounding them at the time.

I have mentioned the need for constant attention to accuracy in prescription compounding. Goldstein, in a series of articles, and Sciuchetti, Roeder and Crossen have given analytical results on prescriptions compounded by practicing pharmacists and students. Brown and others have mentioned spot tests of student prescriptions by qualitative and quantitative methods. In view of the extreme measures used by manufacturers to insure quality products it certainly is not unreasonable to expect a pharmacist to meet rather narrow standards of tolerance. Fortunately the majority of students seem to grasp the concept of accuracy rather quickly but there are others who remain cynical and unbelieving, who follow instructions only as long as they know they are watched and checked. Although this second group responds slowly to teaching, the response can be hastened if it is known that grades are based in part on analytical results.

Under pressure of vigilant policing by the staff and grades based in part on spot testing, the student begins to

change attitude and finally accuracy becomes a habit just as it did much earlier with the willing students of the first group. Obviously it is not feasible to quantitatively check every prescription. No school or college administrator will provide sufficient personnel for that purpose, and furthermore, many of the prescriptions have not applicable analytical methods or qualitative tests. Qualitative testing is used primarily to determine if the student has selected the proper one of two or more related compounds such as sodium phosphate and sodium acid phosphate, phenobarbital and pentobarbital, concentrated acid and diluted acid, etc. With respect to quantitative tests, I suggest that it is not always necessary to obtain extreme accuracy. Some analytical procedures can be modified to shorten the over-all time and still give results which serve the purpose.

We have used pH meters (glass electrode) in a limited way with considerable success. Determinations can be made rapidly as long as a series is confined to the same type of prescription. Each of our students dispenses three ophthalmic solutions adjusted for osmotic pressure and pH. Without advance knowledge by the students, the pH of each is determined by one of the staff. When the results are made known to the individual students there is a noticeable improvement in performance. Twice we have detected collaboration between students when three prescriptions from a like number of students on adjacent desks had identical pH values far removed from that expected.

The pH meter is of value in checking mixtures in which buffering is not the primary objective. Many combinations will have a certain pH value which of course must be determined in advance from a carefully compounded sample. If the student product varies appreciably from this value, it is usually an empirical indication of inaccurate work.

If there is a colored ingredient, a colorimeter can be used for checking purposes. This method is applicable to preparations of vegetable drugs or those containing added coloring. To make this a valid approach, all stock bottles must contain portions of the indicator preparations from the same lot as the standard sample.

At the moment we are investigating the use of a Coleman Model B Spectrophotometer and a Beckman Quartz DU Spectrophotometer for spot checking. The theory looks promising, particularly for detecting omission of potentially troublesome ingredients from complex mixtures or for serious deviation

from prescribed strength.

What I have said thus far applies primarily to liquid prescriptions. Solid dosage forms require tedious preparatory treatment before chemical or instrument tests can be made. Since time is an important and practical consideration, it appears that analytical spot-checking of such medication will be slighted for some time, at least by our staff. We have not investigated spectrochemical methods.

I have devoted considerable time to this phase because I believe it offers a means of spurring students to more accurate work and it also indicates more precisely to the staff than mere observation during laboratory time, the quality of the compounded prescriptions.

Audio-visual aids are of considerable value as teaching tools. In 1942 Brady described the preparation of films depicting various techniques used in pharmaceutical practice. Wittich, and Ballard, published material in this field. An ad hoc Committee of the A.A.C.P. chairmaned by Brodie has given excellent service in assembling information and preparing films. Available for rental or purchase is a number of teaching films prepared under the direction of this Committee. They show manipulations and techniques used in preparing tablet triturates and suppositories and in manual filling of powder and liquid prescriptions. For best results the films must be shown two or three times to the class before work is undertaken in laboratory.

One important objective of the course is to study representative original prescriptions for various forms of hand-writing, abbreviations and format. For all other purposes, typewritten prescriptions or prescriptions written by staff members usually will suffice. At one time original prescriptions from store files were readily acquired but since the advent of legend drugs, pharmacists will release such prescriptions briefly or not at all. Although urgency of returning the prescriptions restricts the source to the local geographical area, the study is still worthwhile. Original prescriptions can be projected on the screen with an opaque projector or from a film-slide. With facilities for preparing slides, the photography can be done quickly and the originals then returned to the pharmacy without loss of time. We make film-slides with a Memo Copier, using positive film to prepare a negative from which the positive for projection is obtained with a Memo Positive Printer. Direct positive film is available which eliminates the need for the printer. Actually any 35 mm. camera with suitable attachment will serve the purpose. The

copying equipment is maintained in readiness during the period of time in which the prescriptions are borrowed.

The tape recorder can be used to record lectures for use with the projected prescriptions and it also can be used to make recordings of student recitations on these prescriptions. The recordings can be played back by the professor in private or before the class as part of training in self-expression. At a teachers' conference in 1949, Slesser and Slone reported experiences with film-slides and tape recordings.

Even though students are given individual responsibility in the routine laboratory work we have found many of them still jittery and confused during the day-long practical examination portion of the state licensing examination. To correct this situation there were introduced into the laboratory work two or three "practical examinations" each quarter with conditions the same as those on the state examinations, i.e. the students are given a number of prescriptions to compound in a limited time including a written description of the methods used. This is followed within a day by an oral examination on the same material. Students are allowed to use the U.S.P., N.F. or an epitome in the laboratory. The plan has made a noticeable improvement in student confidence and performance on state examinations.

My discourse thus far should indicate that effective teaching in both lecture and recitation work requires a greater ratio of faculty to students than found in other professional and science courses. It is a fact which is difficult for some teachers in the other courses, and some administrators, to understand. Recitation sections should have a limited number of students so that there is no chance for some to remain inarticulate day after day. Laboratory classes should be small or have sufficient faculty to compensate for the larger number. Because of their greater experience it is highly desirable, but not always possible, to use only full-time faculty. Many graduate teaching assistants are not consistent performers in this respect. Their prime interest is in graduate courses of study and teaching service is a chore of importance only because it is a source of income. Furthermore they do not have the broad experience and background of the more mature, full-time teacher.

Over the last 10 years we have used regularly two graduate teaching assistants and two full-time faculty members. With the assistants, I have found it necessary to spend considerable time teaching them the subject material before presenting it to the class. During this 10-year period

we have had as high as 85 students and as low as 40. If the enrollment is over 45, sectioning of the laboratory class is necessary. If we used only two full-time faculty members and no graduate teaching assistants, it would be necessary to increase the number of sections, and therefore the clock-hour time, of these people to the point where they would have no time for other interests. Fortunately all schools and colleges are not as restricted in personnel.

I have discussed in general terms some of the problems encountered in teaching Dispensing Pharmacy and made, what I hope, are helpful suggestions to meet these problems. I do not claim them to be original with me. It is expected and hoped that more detailed discussion and personal opinions will be brought out during the Section A Workshop this afternoon.

**Editor's Note:** Twenty-two principal references were cited, all of them in the Am. J. Pharm. Ed., and J. Am. Pharm. Assoc.

**Discussion:** No questions were recorded following this paper.

#### TEACHING HOSPITAL PHARMACY AND HOSPITAL PHARMACY ADMINISTRATION IN THE UNDERGRADUATE PROGRAM

Herbert L. Flack

P. C. P. & S.

In the current issue of two widely-read journals, there are several articles that pertain to hospital pharmacy practice. These are part of some eight to ten journals that routinely have such a section. Twenty years ago, probably only one journal had a section discussing hospital pharmacy in every issue. Ten years ago, only four or five journals carried routine sections devoted to hospital pharmacy practice and problems. The practice of pharmacy in hospitals has grown from what in general was a job for females, for the physically handicapped, or the pharmacists who could no longer stand the strenuous pace of retail pharmacy practice, to a position of such importance that this week it receives two places on the program.

#### Statistics -- 1949 and 1954.

A review of recent statistics makes one take a second look

at any statement made to the effect that educators have accepted hospital pharmacy practice as a distinct and rapidly growing speciality of pharmacy. In 1949, the author undertook a survey of hospital pharmacy educational programs. In a 93.5% return from the accredited schools of pharmacy, true lecture instruction in hospital pharmacy at the undergraduate level was found in only 18 schools. Laboratory or dispensing instruction in the hospital pharmacy affiliated with the school of pharmacy, but with nospecific lecture series, was noted in 6 schools. This latter is not a true educational effort at teaching hospital pharmacy. At the time of this survey, one of the deans replied that there was no need for segregated courses in hospital pharmacy. He felt that a lot of the courses advertised as courses in hospital pharmacy were not so, but were fundamentally the same as courses in basic dispensing pharmacy.

In 1954, the author again undertook a survey of hospital pharmacy educational programs. In a 95% return from the accredited schools of pharmacy, lecture instruction only was noted in 8 schools, lecture and laboratory instruction in 12 schools, and 15 schools replied that instruction was offered but did not forward course descriptions. Twenty-eight schools replied in the negative, and 7 schools offered laboratory instruction only, which is the equivalent of senior pharmacy dispensing courses. Summarizing these statistics, we have in 1954, 50% of the schools stating that lecture, or lecture and laboratory instruction in hospital pharmacy was made available or would be available the following year to the senior student on an elective basis. This shows a desirable increase, but still leaves 50% of the nation's schools which do not offer instruction in hospital pharmacy or hospital pharmacy administration.

#### Hospital Pharmacy Practice Defined

In Exhibit A, attached hereto, the author has attempted to define hospital pharmacy and to offer some responsibilities of the hospital pharmacist. Every person teaching hospital pharmacy administration should review this list of responsibilities plus the responsibilities listed in the MINIMUM STANDARD FOR PHARMACIES IN HOSPITALS. At this point it is important to review some of the Extra features of hospital pharmacy practice as listed in Exhibit A.

In addition to the usual responsibilities, pharmacy service may also encompass several other tasks, as appended to Exhibit A.

In hospitals today, we have a void, almost, in providing

pharmacy service to the small hospital of 150 beds or less. Statistics show that the majority of all hospitals are under 200 bed capacity, and that the bulk of these are about 50 to 100 bed capacity or less. It is in these hospitals that the patient has little or no protection or coverage by a registered pharmacist. It is in these same small-bed-capacity hospitals that there is the most difficulty in convincing the hospital administrator of the need for or value of a pharmacist. In the small hospital, the pharmacist has insufficient true pharmaceutical activity to keep him busy.

#### Necessary Special Courses for the Hospital Pharmacist

With the advent of the so-called five or six year course, pharmaceutical educators must add to their curriculum certain elective courses besides the one in hospital pharmacy administration. By doing this, they will help to provide valuable persons who can fill the position of pharmacist in the small hospital and yet accomplish other professional duties, and concurrently warrant and achieve a good salary.

The course CENTRAL MEDICAL AND SURGICAL SUPPLY is needed so that the pharmacist, a logical person to supervise this activity understands the underlying principles. This course should include a thorough discussion of the inhalation therapy service operation, since this is another service for which the pharmacist can logically accept responsibility. There is also the course in RADIOISOTOPE TECHNIQUES, which provides background so that the pharmacist can operate the radioisotope laboratory in the hospital. All three services, central medical and surgical supply, inhalation therapy, and radioisotope laboratory which are new to hospital pharmacy practice in the last few years, are activities in the hospital encompassing the use of drugs and products listed in the U.S.P., N.F., and N.N.R. The pharmacist can almost demand supervision of these operations by virtue of the Board of Pharmacy regulations requiring that drugs and official products be dispensed by or under supervision of a registered pharmacist.

Very few pharmacists, however, are seeking responsibilities in addition to the basic pharmaceutical responsibilities as they have been known these past ten or fifteen years. The reason they are not, is that the schools of pharmacy have not provided the educational programs to train them.

I must point out, that these three services under supervision of the pharmacist-in-charge, are not additional services peculiar to the small hospital. At the Jefferson Medical College Hospital, an 1100 bed hospital, where I am Director

of Pharmacy Service, the pharmacy presently handles the inhalation therapy service, in addition to having an extensive program of non-sterile products, and intravenous and irrigating solution manufacture. We have found the opportunity recently to suggest to the administration that pharmacy service supervise the activity of the radioisotope laboratory, and have found the administration receptive to the proposition. We are biding our time until some future opportunity presents itself to suggest to the administration that pharmacy service supervise the activity of the central medical and surgical supply. So you see it is possible to have a really comprehensive pharmacy service in a large or small hospital.

At this point, it is essential to review the course hours and purpose of the courses so far discussed. Hospital Pharmacy Administration is suggested as at least two lecture hours per week for the first semester of the senior year. In addition, two to four laboratory hours per week for the second semester, and one conference (seminar) hour per week for the first and second semesters. This would be an optional course, for senior students desiring to major in hospital pharmacy. This course proposes to acquaint the senior student with the interesting potentialities of hospital pharmacy practice, so that he might specialize through some postgraduate program, to work toward an administrative hospital pharmacist position. The course also proposes to prepare the senior student with at least the basic concepts of hospital pharmacy practice so that on graduation he is better prepared to accept employment in a hospital pharmacy as a staff pharmacist.

The course in CENTRAL MEDICAL AND SURGICAL SUPPLY OPERATION should be given in at least two lecture hours and two laboratory hours per week for one semester. This should be required of senior students majoring in hospital pharmacy. This course is to acquaint the senior student majoring in hospital pharmacy with the interesting and highly technical potentialities of medical and surgical supply administration as it might function in the hospital as a division of pharmacy service. It should prepare the student with at least the basic concepts of medical and surgical supply administration so that on graduation he is better prepared to accept employment in a hospital pharmacy as a staff pharmacist in charge of the medical and surgical supply division or the sterile products division of pharmacy service.

The course in RADIOISOTOPE TECHNIQUES should require at least one lecture hour, one conference hour, and three laboratory hours per week for one semester. It should be required for senior students majoring in hospital pharmacy. The purpose

of this course is to provide the senior majoring in hospital pharmacy with theoretical and practical information that he might assume responsibility for operation of the radio-isotope laboratory in the hospital, when it is under supervision of pharmacy service.

It is essential in the junior or senior year to present two other courses that are prerequisites to hospital pharmacy practice. These two courses are offered at the moment by many schools of pharmacy but not by all of them. The first course is in BASIC MANUFACTURING PHARMACY where the theoretical and practical aspects of the use of equipment, usually for manufacturing or bulk compounding of non-sterile products is presented. The other course is in PARENTERAL or STERILE PRODUCTS MANUFACTURING where the bulk compounding or manufacturing of sterile products is presented in both theoretical and laboratory aspects.

There are four additional courses that schools of pharmacy should make available to, or preferably, require, junior or senior students to take. These courses would be valuable to majors in hospital pharmacy, in pharmacy, in pharmacy administration, in manufacturing pharmacy, and the retail pharmacist of the future will need them also. The first course is TOUCH TYPING. This is probably the incorrect terminology, but it represents a course that is needed if a pharmacist is ever to express himself in print or to make an address such as this. The time consumed in writing in longhand, having it typed, correcting the words the typist could not decipher correctly, etc., are valuable hours wasted. A second course is INCREASING READING SPEED. This again is probably incorrect terminology, but it represents a course that will teach the junior and senior student to read more rapidly and to comprehend more than when he began. This is needed to cope with the voluminous literature of pharmacy and allied fields that must be reviewed by the modern pharmacist. This course can be offered in one hour per week for one semester, or can be elaborated to a two semester hour total. There is need for a third course, PERSONNEL SUPERVISION. The hospital pharmacist has opportunity to teach pharmacology and pharmaceutical arithmetic to nurses, and teach pharmacy and related subjects to the medical student and intern and resident physician. In over-all view, the hospital pharmacist has great potential for teaching hospital personnel a variety of subjects, but where is he to obtain the theoretical background for this activity? I believe this is a responsibility of the schools of pharmacy at the undergraduate level, for a fundamental course, and at the graduate level for a more elaborate presentation of the techniques of education.

Who Should Teach Hospital Pharmacy Administration (Under-Graduate Course)?

It is a pleasure to note a prominent educator concurring in the opinions of the Committee on Education of The American Society of Hospital Pharmacists. This educator, Dr. Glenn L. Jenkins, wrote recently that this course should be taught by "A well qualified teacher and one well qualified and experienced in hospital pharmacy." This almost indicates that the choice of person to present hospital pharmacy administration at the undergraduate level is an above-average, practicing chief pharmacist who by his educational and other qualifications receives faculty status in the school of pharmacy.

Syllabus For The Course Hospital Pharmacy Administration

In the May-June, 1955, Bulletin of the American Society of Hospital Pharmacists, there was published a syllabus for this course. This was originally prepared in 1951, publication being held up until this time. In Exhibit B there is a "Suggested Subject Sequence." It is the author's findings that for the undergraduate course, it is best not to discuss the hospital only for the first five or six lectures. Thus, he has integrated into each of the early discussions a concurrent discussion of the hospital pharmacy. You will note this when you compare the author's suggested sequence with the sequence as found in the syllabus. You will note a few other changes in sequence which the author has felt necessary to make in his own program. There is no doubt but that the syllabus provides a good basic outline for the teacher of hospital pharmacy at the undergraduate level, although it can be modified to suit his desires and the particular needs of the school's overall program. In reviewing the course descriptions of the several lecture courses this past year, the author noted that many lecture courses labeled hospital pharmacy or hospital pharmacy administration were stressing the business side of hospital pharmacy only, such as records and reports, inventory, etc. This is wrong, for there must be an introduction to the hospital, a description of overall hospital operation, and other features, to provide a complete view of the picture.

Speaking of the complete view, one educator has stated that he feels stress should be given to the total activity and total understanding of the pharmacy as a unit, thinking in terms of the small hospital pharmacy, where versatility of personnel activities is essential.

### Textbooks, Journals, and Literature References

The Exhibit C presented as a part of this paper lists certain texts, journals, and literature references that are useful for the educator to review and for the student to utilize. Certainly, every person teaching hospital pharmacy should hold membership in The American Society of Hospital Pharmacists and in The American Hospital Association. Since these references are listed for convenience, of the educator, they will be discussed no more than to state that the May-June, 1955, A.S.H.P. Bulletin deserves careful and detailed reading.

### Slides as Visual Aids

The Division of Hospital Pharmacy has about 150 slides from which the teacher may select for rental or purchase, slides to show to his class. The author has his own set of these, plus additional slides from photos that he has taken, or pictures or cuts that he has observed. For the trouble involved in shipping slides, and the way the postal department manhandles packages, it is easier to purchase a set. Not every teacher will want the same slides to show his class. For the teacher who has not yet borrowed slides from the Division, this is a good list to begin with.

### Films as Audiovisual Aids

Exhibit D lists certain films that the author considers above-average and as having special interest to the undergraduate student taking hospital pharmacy administration. There are additional films that are worthy of showing to students in the graduate program, but that is not my subject. These films may be shown best during the weekly conference periods since such periods provide an opportunity to discuss the text of the film after it is shown. This is very important, and it is important, also, to review the film beforehand so that the teacher will have made notes to lead the discussion. The films about personnel situations are usually located in factory backgrounds, but they provide a good teaching aid that can be applied to hospital pharmacy practice. As stated in Exhibit D, the educator should review the American Hospital Association's "1955 Catalog of Services" for other films that are worthy of showing.

### Other Visual Aids

The author had hoped to present additional exhibits that would have listed "free goods." Time did not permit this

list to be made, although the author's files are full of material that is available free for the asking. It is hoped that such a listing will be available by next convention time, and will be presented to the 1956 Annual Meeting of the American Society of Hospital Pharmacists. Any person desiring a copy of the material should request same of the author and it will be forwarded in the future. On the last page of the syllabus there is a "List of Suggested Exhibits." The majority of these are still available, although not all of them are for issue to the student. Many are of primary interest to the educator.

As a token of what the author hoped to do, there has been distributed a series of peg-board type, printed requisitions. These are available from the author on request of any teacher of hospital pharmacy, in amounts sufficient for the number of students taking the course. It is the author's feeling that two few hospitals have printed requisitions, and still fewer hospital pharmacies have the peg-board type. Since this type is very desirable, it is good to show the student, and to encourage his use of them in the future.

The author considers it desirable to issue as part of the lecture on manufacturing and manufacturing equipment, brochures from the several companies in that part of the nation that provide the basic pharmaceutical manufacturing equipment used in the hospital pharmacy. Your local Blue Cross Plan, your state or local hospital association, and your regional hospital council can be of help in providing other give-away material that helps to put a point over to the student.

#### Guest Lecturers

The author has had certain unfortunate experiences with guest lecturers. In the one case a state board of pharmacy secretary was asked to discuss laws and regulations affecting hospital pharmacy practice. The end result was that the guest lecturer presented basic information that might have been of value to a retail pharmacist, but neglected completely the hospital control of narcotics and tax-free alcohol, and other phases of the subject, which had to be added in a subsequent lecture.

Guest lecturers from the various equipment companies or material suppliers have a tendency to talk in too great detail about the accomplishments of their product, and usually do not care to make a public statement about competitive

products, other than to say, usually, that they are inferior.

### Field Trips

The author has noted great satisfaction from his senior students through field trips to other hospitals, reviewing briefly the hospital and then in detail the hospital pharmacy. These are carried on as part of the laboratory course, and offer a further reason for the laboratory session to be of four hours' duration. Unfortunately in the Philadelphia area, pharmacies in small hospitals have not much to show. Of course it is possible to learn by seeing things done the hard way or by seeing them not done, or undone, as might be said. Such a teaching method is good following the student's having seen originally the correct method for accomplishing this technique or procedure. Also, in the Philadelphia area, and I believe this is typical of most areas, very few hospital pharmacists are engaged in manufacturing of non-sterile products, and hardly any are engaged in manufacturing of sterile products. Thus, it is difficult to provide through field trips to other hospitals, the observations that you feel the student should make. That is why in Philadelphia, the student has been permitted to see only the operations of pharmacy service at Jefferson, a two-hour review of the local V. A. Hospital, plus a unique and very modern union medical center outpatient set-up. This coming year, because of certain personnel changes in the area, we will be able to add a 300 bed hospital and a 600 bed hospital to our field trips. It also seems desirable, if the plant is convenient, to schedule the students for a tour of a company that prepares rubber stoppers for injectable products, and a company that prepares the Type 1 flasks for injectable products. Of course, at the close of each field trip, a critique is held, and if things have been noted that are questioned by the student, this provides the opportunity to straighten him out. One educator has suggested that the field trips be divided so that at least one is at the beginning, one at the middle, and one at the end of the semester. He has noted that with such planning, the student, with each succeeding trip becomes more aware of what he is inspecting.

### Laboratory Instruction in Hospital Pharmacy Administration

As noted in the early part of this presentation, there are some courses titled hospital pharmacy that are improperly labeled. These are courses where the junior and/or senior students are assigned to the dispensing area of the hospital pharmacy for periods of work, and from the author's observation,

never learn more about the hospital than that. They do obtain good compounding and dispensing experience, and have occasion to handle drugs that are often not called for in the retail pharmacy. They receive no lecture instruction into what makes the hospital pharmacy run, how it fits into the over-all hospital operation, etc.

Laboratory instruction in hospital pharmacy is best accomplished following completion of the lecture series in hospital pharmacy administration. At this time, the student should have completed the course in manufacturing pharmacy, in parenteral or sterile products manufacture, in radioisotope techniques, and other preliminary experience in the hospital. Then, if scheduling permits four-hour morning laboratory periods, the student can spend one period in general or in-patient dispensing, another in outpatient dispensing, another in non-sterile manufacturing, another period in sterile products manufacturing (if this department is sufficiently elaborate in scope he can spend one full period in small volume work and another period in large volume work), and several periods touring other hospitals and the pharmacies therein. A period in the central medical and surgical supply would follow, then one in the radioisotope laboratory, one with the inhalation therapist, and further sessions providing additional repetitive or varied experience. This is the type of laboratory instruction that should be carried on, almost on an individualized basis with the student working with the pharmacist or other person to whose supervision he is assigned. One feature of laboratory instruction that is especially desirable is that the student be permitted actually to work with the preceptor, rather than to watch as an observer. Students have indicated that they received the least stimulating experiences from laboratory periods where they were observers in an operation, rather than workers.

One essential of laboratory instruction in hospital pharmacy is to develop versatility in the student. It has been stated that if he can develop his skill in getting the routine work accomplished, he will have time later in the day to perform some of the more scientific and professional functions. Unless the student realizes this vital factor, he will always excuse himself, in the future, from the real progressive functions and additional services because he thinks he lacks time.

#### Conclusion

The author has attempted to present his observations on the teaching of hospital pharmacy administration as an

undergraduate course. He is certain that some points will find disagreement, but he sincerely feels that the teaching aids and other material have some value in presenting an undergraduate course in hospital pharmacy administration. He calls to the attention of all educators the statement of Blauch and Webster, from THE PHARMACEUTICAL CURRICULUM, "In addition to the fact that a number of graduates in pharmacy will serve in hospitals, there is another reason why attention should be given to instruction in hospital pharmacy--it emphasizes pharmacy as a health service and extends its professional aspects. For this reason the colleges may well look forward to the day when all their students will have some instruction in this field and some first hand experience with it."

#### EXHIBIT A THE HOSPITAL PHARMACY AND PHARMACY SERVICE DEFINED

The hospital pharmacy is that essential professional service or department in a hospital which is under the direction of a professionally competent, legally qualified, usually specially-trained pharmacist. Pharmacy Service usually encompasses the following responsibilities:

- A. The dispensing of drugs, chemicals, and pharmaceutical preparations.
- B. The filling and labeling of all drug containers issued to services and to inpatients from which medication is to be administered.
- C. The bulk compounding or manufacturing of pharmaceuticals.
- D. The compounding and dispensing of prescriptions for both inpatients and outpatients.
- E. The preparation, sterilization, and control, of parenteral and irrigating solutions when manufactured in the hospital.
- F. The dispensing of all narcotic drugs, alcohol, and other proscribed drugs with close control of these drugs when dispensed to the nursing units.
- G. The necessary inspection of all pharmaceutical supplies on all services on at least a bi-monthly basis.
- H. The maintenance of an approved stock of antidotes and other emergency drugs.
- I. The specification both as to quality and source for purchase of all drugs, chemicals, antibiotics, biologicals, and pharmaceutical preparations used in the treatment of patients.
- J. The furnishing of information concerning medications to physicians, dentists, and nurses.
- K. The maintenance of a system of records and bookkeeping for charging patients for drugs, services, and pharmaceutical supplies issued from pharmacy.

- L. The teaching of, or cooperation in teaching pharmacology and arithmetic to students in the school of nursing; offering a continuing teaching program to the staff nurses; lecturing during the course in pharmacology and during the junior and senior year in medicine; to discuss new drugs, the hospital formulary, and prescribing in the hospital as part of the medical student and intern training program.
- M. Consultation with the Pharmacy and Therapeutics Committee to develop a formulary of accepted drugs for use in the hospital.
- N. Maintaining control of research drugs used throughout the hospital
- O. The preparation of periodic reports on the progress of the department for submission to the administrator of the hospital.
- P. The preparation of public and professional relations material reflecting pharmacy service in its proper perspective.

In addition to the usual responsibilities, pharmacy service may also encompass the following:

- A. The purchase of all supplies for the hospital.
- B. The operation of a medical and surgical supply service dealing in sterile and non-sterile professional supplies.
- C. The operation of the hospital storeroom.
- D. The operation of an inhalation (oxygen) therapy service.
- E. The operation of the radioisotope laboratory.
- F. Other professional responsibilities, including on occasion, those of administrator or assistant administrator.

In the modern hospital, pharmacy service is fast becoming the important service in the hospital where any question concerning drugs, chemicals, pharmaceutical products, medical, surgical and other supplies, can be answered for the physician, nurse, technician, or non-professional worker in the hospital. Just as in the neighborhood pharmacy, pharmacy service in the hospital can be best known for its information and consulting service to the other professional personnel. Additional responsibilities of pharmacy service in the hospital are elaborated in the **MINIMUM STANDARD FOR PHARMACIES IN HOSPITALS.** (Copy available from the Division of Hospital Pharmacy, 2215 Constitution Ave., N.W., Washington 7, D. C.

## EXHIBIT B

## SUGGESTED SUBJECT SEQUENCE

## Subject Sequence Number\*

1. Definition of a Hospital, Hospital Pharmacy, and Hospital Pharmacist
2. Development of hospitals
3. Development of hospital pharmacy
4. Functions of the hospital
5. Responsibilities of the hospital pharmacy
6. Classification of hospitals
7. Classification of hospital pharmacies
8. Organization and administration of the hospital
9. Organization and administration of the hospital pharmacy
10. Ethics and standards of practice
11. Hospital organizations and publications
12. Personnel
13. The pharmacist-in-charge in his role as a supervisor
14. Pharmacy and Therapeutics Committee
15. Laws and regulations
16. Hospital architecture
17. Physical plant
18. Purchase and supply
19. Inpatient dispensing
20. Outpatient dispensing
21. Miscellaneous dispensing
22. Manufacturing
23. Manufacturing of non-sterile products
24. Manufacturing of sterile products
25. Manufacturing control
26. Packaging and labeling
27. Formulation and research
28. Records and reports
29. Educational programs
30. Central medical and surgical supply (Pharmacy-supervised)
31. Inhalation therapy service (Pharmacy-supervised)
32. Radioisotope laboratory (Pharmacy-supervised)
33. The minimum standard for pharmacies in hospitals.

Copies of the syllabus for the course in hospital pharmacy administration are available for a small fee from the Division of Hospital Pharmacy.

\*Note that this does not imply one hour per lecture or per subject; it merely numbers the subjects for further reference.

## EXHIBIT

## C TEXTBOOKS, JOURNALS, AND LITERATURE REFERENCES

Textbooks

Remington's Practice of Pharmacy, 10th Edition, by Cook-Martin  
(See Chapter 104, page 1335, and other chapters)

Remington's Practice of Pharmacy, 11th Edition, by Cook-Martin  
(Available about January, 1956. See chapter 91, and other  
chapters)

Hospital Organization and Management, 2nd Edition, by MacEachern  
(Note that a 3d edition is due in the fall of 1955)

Journals (Containing specific articles on hospital or  
hospital pharmacy practice)

Bulletin of the American Society of Hospital Pharmacists-Bi-  
monthly

American Professional Pharmacist (Hospital Pharmacy Forum)  
Monthly

Journal of the American Pharmaceutical Association, Practical  
Edition - Monthly

The Hospital Pharmacist (Canadian) - Bimonthly

Hospitals - Semimonthly

Hospital Management - Monthly

The Modern Hospital - Monthly

Southern Hospitals - Monthly

(Note that this listing is not aimed at including all  
journals that occasionally contain an article about hospital  
or hospital pharmacy practice)

Literature References

## Comprehensive Bibliography on Hospital Pharmacy

Originally published as part of January-February, 1951  
Bulletin of A.S.H.P.

First supplement published in the January-February, 1953,  
Bulletin of A.S.H.P.

Second supplement published in the January-February, 1955  
Bulletin of A.S.H.P.

(Available for purchase from the Division of Hospital  
Pharmacy, 2215 Constitution Avenue, N.W., Washington 7,  
D. C. at cost of \$1 for each unit.)

Cumulative Index of Hospital Literature, 1945-49 (Cost \$5)

Cumulative Index of Hospital Literature, 1950-54 (Cost \$6)

Index of current hospital literature (semi-annual; subscrip-  
tion is \$3 per year; available from The American Hospital  
Association, 18 East Division Street, Chicago 10. Ill.)

A Guide to Information Sources for Hospital Pharmacists, by  
Gloria Niemeyer--Bulletin of A.S.H.P. 12:275, 1955)

Education and Internship Number, Bulletin of the A.S.H.P.,  
May-June, 1955. (Contains valuable information for  
educators in hospital pharmacy.)

#### EXHIBIT D

#### FILMS AS AUDIOVISUAL AIDS

Films are grouped according to the subject matter. The time, renting agency, and cost for rental are included in that order. There are hundreds of films available from one source or another. The following films were selected from a showing of 37 films in the 1954-5 school term. These films were selected from the A.H.A. listing of about 100 films. Undoubtedly, other good films are available.

#### ORIENTATION TO THE HOSPITAL

Ambulance Doctor - 18 minutes, American Hospital Association \$4.  
Another Light - 22 minutes, Your State Department of Health, or  
U. S. Public Health Service, Washington 25, D.C., free  
City of the Sick - 20 minutes, Association Films, Inc., 35 W.  
45th Street, NYC, \$4  
House of Mercy - 17 minutes, American Hospital Association, \$4

#### CHIEF PHARMACIST IN HIS ROLE AS A SUPERVISOR

As Others See Us - 15 minutes, American Hospital Assoc. \$4  
Telephone Courtesy - 25 minutes, Bell Telephone Company, free  
The Boss Didn't Say Good Morning - 12 minutes, Association  
Films, Inc., \$2.  
Introducing The New Worker to His Job - 16 minutes, Association  
Films, Inc., \$2

#### MANUFACTURING OF STERILE PRODUCTS

Pressure Steam Sterilization - 26 minutes, Ideal Pictures  
Corp., 233 W. 42nd St., New York 36, N.Y. or the regional  
office in your area, free

#### CENTRAL MEDICAL AND SURGICAL SUPPLY (PHARMACY SUPERVISED)

Hypodermic Syringes and Needles, Their Care and Function  
(Part 1 - 20 minutes, Part 2 - 25 minutes) Becton,  
Dickinson & Co., Rutherford, N.J., free  
Central Supply Service - Available from University of Toronto,  
Department of Hospital Administration, School of Hygiene,

Toronto 5, Canada, in the near future. An old copy is available on loan from A.H.A. for \$4 (A 1955 revision is in process, and the university will advise of its availability, if you request)

#### INHALATION THERAPY SERVICE (PHARMACY-SUPERVISED)

Oxygen Therapy - 30 minutes, Linde Air Products Co., 30 E 42nd St., NYC, free

#### RADIOISOTOPE LABORATORY ( PHARMACY-SUPERVISED)

You Can Be Safe from X-Rays - 10 minutes, American Hospital Association \$4

The Atomic Apothecary

Fundamentals of Radioactivity      Running time and charges not  
Properties of Radiation      known--all available from  
Practical Procedures of Measurement-Atomic Energy Commission,  
Oak Ridge, Tenn.

#### MISCELLANEOUS

A Way With Fire - 30 minutes, Bell Telephone Co., free  
(Good if time permits)

Prescription for Life - 15 minutes, American National Red Cross, Alexandria, Va., or your regional office, free

#### Addresses:

American Hospital Association, 18 East Division Street,  
Chicago 10, Ill.

Bell Telephone Company - your local office

Association Films, Inc., 79 E. Adams St., Chicago 3, Ill.,  
or your regional office.

NOTE: Write to A.H.A. for copy of the 1955 "Catalog of A.H.A. Services." This catalog describes the content of each film, where to purchase a copy, etc. Note also that some films are a few years old.

Discussion: No questions were recorded following this paper.

#### MANUFACTURING PHARMACY AT THE UNDERGRADUATE LEVEL

Henry P. Bauman

University of Iowa

The necessity of acquiring a knowledge of the principles

of compounding formulae on a scale greater than that of the compounded prescription is becoming more important to the pharmacy graduate with the passing of each day. There are several types of positions, each requiring a knowledge of manufacturing pharmacy, into which our bachelor of science graduates may drift. The most common of these are:

1. The pharmacy which manufactures a small line of products which are sold within the store, and in a limited area surrounding the store. This type includes those stores which manufacture special items for small hospitals which do not employ a full-time pharmacist and--in some cases--the small hospitals in which no pharmacist is employed.
2. The private formula laboratory. There are many such organizations, throughout our nation, which specialize in compounding the favorite prescriptions of dispensing physicians. Dispensing, in any form, by physicians is an evil which we pharmacists are trying to minimize and eventually eliminate. However, until Pharmacy cleans its skirt and continues to wear a clean skirt, I feel we must train the personnel of those installations which supply the dispensing physician with his pet "shot-gun" preparations. There is, however, a ray of hope that such installations may eventually become pharmaceutical manufacturing companies of the first order. The small sub-contracting laboratory may be included in this classification. These installations are not as a rule supported by extensive capital, and are interested primarily in making a substantial profit. Hence, they do not care to offer anyone a large beginning salary, and to obtain the best trained personnel at a minimum salary, they seek out well-qualified graduates. Again as bitter as the pill may seem to be, I say it is our duty to train the personnel of such organizations.
3. Hospital pharmacy. The trend today is for certification of a hospital pharmacist who has served a two-year internship and who has received the Master's degree in Hospital Pharmacy. I am totally in favor of this program, but one must admit that many small hospitals are financially unable to employ a Certified Hospital Pharmacist and must operate a pharmacy which is staffed by one or more graduates at the baccalaureate level, or in many cases, by a part-time pharmacist. These pharmacists, if they have a basic knowledge of manufacturing processes, will be enabled to save their employers untold hundreds of

dollars annually by manufacturing many of the products which are being sold by the pharmaceutical manufacturers. The successful hospital pharmacist with a Bachelor's degree who has selected the small hospital as his career, or the Bachelor who has accepted a temporary appointment in any hospital (regardless of size) for the express purpose of obtaining professional experience, should be trained in the basic principles and processes of manufacturing pharmacy for economy of operation.

4. Industrial pharmacy. Some of the many facets of industrial pharmacy in which manufacturing pharmacy education plays a major role are: production, production supervision, product development and control. The baccalaureate graduate who has a thorough background in manufacturing procedures will be more receptive to the practices of a large industrial company and will advance more rapidly than the inexperienced employee.

Opinions among teachers of pharmacy as to whether manufacturing pharmacy should be taught at the undergraduate level are divided. Those of us who feel the undergraduate should receive this training are offering several types of courses that train the student to prepare large quantities of pharmaceuticals in an accurate and efficient manner.

These courses may be conveniently placed in four classes and they are:

Course I. This course is required and is taught in colleges of pharmacy which supply the University's Health Centers with pharmaceuticals. Representative of this class is the course taught at the State University of Iowa, College of Pharmacy. The third-year student who has successfully completed beginning pharmacy, arithmetic, general chemistry, qualitative analysis, organic chemistry and pharmacy laboratory has the prerequisites for this course. He attends lectures covering a short review of each class of preparations which is followed by extensive lecture sessions on processing these preparations on a large scale. More time is devoted in lecture to the study of the more important classifications of pharmaceuticals such as: Ointments (ophthalmic and general) and other dermatologicals, Tablets, Capsules, Soaps (liquid and surgical scrub) and Solutions--with

greater emphasis being placed on Parenterals, Elixirs, Syrups, Extractions and Powders.

In the laboratory, the student, under constant supervision of and guidance by myself and assistants, prepares large quantities of the above classes of pharmaceuticals for use by the Health-Science division. For the first time in the student's academic career, he makes preparations which will be used in the treatment of human ills. The student benefits in that he learns by doing. He likewise assumes responsibility for the first time and begins to acquire confidence in himself in the art of compounding medicine.

The student's routine is as follows: He obtains his laboratory assignment from an assignment sheet which is posted at the beginning of the week. He then copies the formula from a master file and calculates the amounts of ingredients which he will use in his preparation. This calculation may require increasing or decreasing the master formula or changing from one system to another, or both. When this is completed, he copies his adjusted formula on a laboratory worksheet. After filling out the worksheet, he studies the ingredients for their chemical properties and uses and to detect the presence of incompatibilities, if any. Before the product is manufactured, the student and instructor confer and discuss the preparation at length and the student is encouraged to make suggestions on the processing of the product. In this way we induce thinking by the student. The conference is ended with the instructor's explanation of the continuous steps of the process. In the laboratory, the student's weights and measures are carefully checked and as the processing continues, the instructor comments on physical changes that may be taking place in an effort to improve the student's powers of observation. When the preparation is finished, it is packaged and labeled; the collected samples are given to the control department; the preparation entered in the product record; and all equipment used and the area are cleaned. This latter activity soon teaches the student to be neat and impresses upon his mind that calculations, caution, care and cleanliness produce better pharmaceuticals.

The equipment employed in this course is as follows:

For solutions, elixirs, syrups and soaps: 4 stainless steel mixing tanks with high-speed mixers; 2 steam-

jacketed, glass-lined mixing tanks; 4 filter presses including a stainless steel hand rubber press for corrosive liquids.

For ointments and other dermatologicals: 2 mixers--one a planetary type; a roller mill; a tube and jar filler; and a tube crimper.

For capsules and tablets: an air conditioned room containing a Kelly-Fitzpatrick shell blender; a batch mixer; semi-automatic capsule-filling machines; 3 tablet machines--one hand-operated; one power-operated single punch and one 16 station rotary; a Fitzmill combined grinder and granulator; one coating pan and one polishing pan.

For parenterals: an air conditioned, positive-pressure, filtered air room, containing a torsion balance; a sensitive scale; Millipore filters; automatic and semi-automatic pipetting machine; stainless steel work table tops; still; and autoclave. I add, at this point, that no parenteral or other sterile product is released before satisfactory reports are received from our control division and from the bacteriology department where the products are tested for the presence of bacteria and pyrogens.

This course as it is now being taught, is not entirely satisfactory. Due to the arrangement of the present curriculum, the student has not studied quantitative analysis and is, therefore, unqualified to participate in the quality control procedures. His limited knowledge of this most important phase of pharmaceutical manufacturing is gained solely through lectures and from commentary by the instructors during the laboratory sessions. Time and space do not permit the student to study product development and, again, his knowledge of this phase is limited to lecture material. A more complete course, which will eliminate these shortcomings, has been planned for the extended program which soon will be offered. This course, as now, will be a required course and it will follow the present pattern, but with some additions. The student will have completed the necessary chemistries, including quantitative analysis, at the end of the third professional year. In the fourth professional year, he will study Manufacturing Pharmacy and Quantitative Pharmaceutical Chemistry simultaneously.

In the latter course, the student will perform the control studies on the preparations produced in Manufacturing Pharmacy. Manufacturing Pharmacy will be extended to include an equipment laboratory session in which the student will learn maintenance of

equipment by actually dismantling and assembling the various pieces of equipment and learning that "gadgets" and "whatchamacallits" have proper names. The equipment laboratory session will be conducted during the first semester of the course--then during the second semester, the student will be assigned a product development problem and will carry his project to completion, if possible, again learning by doing.

Course II. This course is an elective and is conducted at the combined undergraduate-graduate levels. It follows much the same pattern as Course I in that it produces pharmaceuticals for the Student Health Center (one school has an extensive scope of service in that it serves the tax-supported institutions within its state). It differs from Course I in that it devotes a portion of its time to product development.

Course III. Like Course II, this course is conducted at the combined undergraduate-graduate levels. It engages in limited production, sharing this phase with the Hospital Pharmacy division. Great emphasis is placed upon control and product development. In this course all chemicals and raw materials purchased are assayed by the Quantitative Pharmaceutical Chemistry section--the student participating in these operations. Chemicals and raw materials which are of the degree of purity required by the manufacturing department's standards and specifications are "tagged" as accepted and are then used in the preparation of pharmaceuticals. Rigid control practice is observed. The student is then assigned problems in product development and eventually acquires the basic knowledge so necessary to successful manufacturing.

Course IV. This interesting course is an elective for senior students and emphasizes intensive study of each important classification of pharmaceutical from the viewpoint of the variety of problems and difficulties with which the manufacturing pharmacist is confronted as the batch size increases. The student, with expert guidance from the instructor, begins his experiments with small quantities of known preparations such as 100 cc. of a simple emulsion. He increases the batch size and observes that the finished product is not identical with the original specimen. After determining the cause of the change, and correcting it, the student continues to increase the batch

size and study his preparation until he has successfully completed a pilot plant batch. He is then given a problem in product development of an unknown preparation in the classification he has been studying. In such studies the student thoroughly acquaints himself with product development, control, and the use of pharmaceutical manufacturing equipment.

In conclusion, I feel that we have accomplished our objectives in that we have, and are, educating the student in the fundamentals of production, product development, control, and the use and care of pharmaceutical manufacturing equipment. I, likewise, am of the opinion that we can evaluate the student and be in a position to either advise him to continue in pharmaceutical manufacturing, or to discourage him if we feel he is unqualified.

Discussion: It was asked if this course could be adapted in institutions with rather large classes, or in one which had no outlets for the products. The opinion expressed was that in such cases, the course might become mere theory.

#### ETHICS AND PROFESSIONAL RELATIONS

John F. McCloskey

Loyola University

Emerson (1803-1882), one of the founders of transcendentalism, wrote that a man who can make a hard thing easy is the educator, but Confucius (CA 551-579 B.C.), a great Chinese teacher of ethics, also said, "Learning without thought is labor lost; thought without learning is perilous."

In order that we will have a common base upon which we may develop our thinking, let me present to you some fundamental information pertaining to ethics.

THE CONCEPT OF ETHICS. "Everyone is to some extent familiar with the subject matter of ethics. For, roughly speaking, ethical speculation deals with what is right and wrong. And of this matter no one is entirely ignorant, even though he may not know that knowledge on this point belongs to the province of a science called ethics."

Rough unanalyzed knowledge cannot be called scientific, but it is the starting point from which science develops. So our rough unanalyzed experience of the moral life is the basis of a scientific knowledge of what is right and wrong, and this

scientific knowledge is the science of ethics.

Right and wrong, as our experience tells us, are words that we apply to actions. Experience tells us furthermore that it is not so much what we do as what we intend to do that really is right or wrong. When we intend to do something we are said to will it, and the act of willing is really the action that is morally good or evil.

The object of the act of willing is what we wish to accomplish or possess. This is always something which we conceive of as, under some aspect, desirable. It is a good. A good may be only apparently desirable. In this case it is morally evil; it is a false good. All things may be spoken of generally as goods. Many goods are presented to us and tempt us more or less strongly to go after them and possess them. Which shall I choose? Some I recognize as means to a further end. I see, too, that various men have various ends for which they sacrifice everything else. Life is an important matter. Mistakes made early cannot be corrected later on. What is the real meaning and value of life? Has life any final goal--an ultimate end--a supreme good? This is the question which ethics attempts to answer, and all its special problems in the last analysis focus in this one point.

My voluntary acts lead to or away from this end. When persisted in they develop within me abiding inclinations, termed habits, by which I am disposed readily to seek some new type of good. Ethics deals with my true end, the actions by which I actually tend to or away from it. The good habits or virtues which dispose me to seek it with pleasure and promptness, and the bad habits or vices which are stumbling blocks in the way. We may, therefore, define ethics as the science of the supreme end of human life and of the relations of voluntary acts and habits to the attainment of that end." (A Historical Introduction to Ethics, Moore, p. 1-2)

It is a fact that virtues and vices are moral habits established by practice. It is also a fact that man is responsible for his conduct. He has intelligence enough to perceive various ends of human endeavor: Money and the pleasure it can buy, position and station in civil life and society, social work and religion. He not only visualizes the ends for his activity, but has a wide latitude to select the means for attaining the ends which were chosen in the first place. The power of seeing ends and choosing means by which they may be attained make man a morally responsible agent.

It is from this power of selecting one course of action

rather than another, that habits, in the true and proper sense, are developed.

We know by experience that we have many and conflicting desires. Often the satisfaction of certain desires is against our true welfare. We know we have the ability to develop ideals of conduct, and can and do strive to make our conduct conform to our ideals. The repetition of conduct to conform to ideals eventually makes it easier for us to live in accordance with the ideals. When this is done, we speak of the growth of good habits or virtues. On the contrary, the more constantly we oppose our ideals of conduct, the more easily we slip into types of behavior that are forbidden by our ideals. Thus we develop habits, but they are bad habits which we term vices. In each of these we have taken the leading role, we have directed our own activity.

THE DIVISIONS OF ETHICS. "Man does not exist as an isolated creature but has personal relations with other intelligent beings. He does not attain his end by himself but along with others--to some extent depending on others, and they in some measure depending on him. The end, therefore, and man's personal relations, suggest the natural division of ethics. A discussion of the end--that is of the nature of morality--gives us what might be termed general ethics. This discussion of man's personal relations to this end gives us special ethics. Special ethics has various subdivisions. Man's relation to God gives the ethics of religion. Man's personal rights and their relations to the rights of others, the ethics of law. The ethics of family was termed in the middle ages economy. Aristotle separated the ethics of the state as a special science under the name of politics. In modern times all these branches are often considered under the one heading ethics." (A Historical Introduction to Ethics, Moore, p. 2)

The teacher of ethics should keep in mind that the history of economics was created through economic theories developed and expounded by philosophers.

"Certain economists believed that society could be understood only as a whole; therefore, it should be studied as a whole. It is apparent that students of economics should have acquaintance with thought in other fields such as ethics, political science and psychology. How can man's actions be examined intelligently if the objectives that lie behind are unknown? The economist must have acquaintance with man's reactions to his wants in the form of willingness to strive for their attainment, that he must know something of human incentives. Consideration of ends or objectives is regarded

as being within the province of ethics, that of incentives as part of psychology." (History of Economic Ideas, Whittaker, p. vii)

What men think about economic affairs is influenced by their ideas on ethics and politics.

I will not discuss the activities of the following men who are classed as economists and some few as philosophers, but their writings have influenced religion, ethics, politics, and economics.

Spinoza	1632-1677	Locke	1632-1704	deMandeville	1670-1733
Hutcheson	1694-1746	Hume	1711-1776	Rousseau	1712-1778
Smith	1723-1790	Quesnay	1694-1744	Mathus	1766-1834
Hegel	1770-1831	Marx	1818-1883	Engels	1820-1895

Adam Smith at the age of 36 wrote "The Theory of Moral Sentiments," but he is best known as an economist with his book "Wealth of Nations."

Bernard deMandeville is well known for his "Fable of the Bees or Private Vices, Publick Benefits."

All of these, and many other writers on economics expounded theories which have created problems that only sound logic, good psychology and Christian ethics can solve.

The following are usually the title heads of economic theories or writings: Wealth and Human Industry; Movements for Social Reform; Population; Money; Profits; Wages; Interest; Rent; Value; Production; Prosperity and Depression; Property and the Distribution of Wealth.

I recommend to the teacher of ethics "A History of Economic Ideas, by Edmund Whittaker, Longmans Green Company, 1940. This book supplies a close-knit and rounded story of the theories that have affected man down to our present day.

THE RELATIONS OF ETHICS TO THE OTHER SCIENCES. "Since the days of Aristotle, ethics has been one of the divisions of philosophy. It never attained even quasi independence of which psychology with its experimental methods may boast. According to Aristotle, sciences are either practical, constructive, or theoretical. Practical philosophy embraced ethics and politics. It had to do with the guidance of human actions to their proper end; ethics dealing with the actions of the individual, politics with those of the state. Among the philosophical disciplines, ethics is most intimately related

to psychology and theodicy. Logic bears no closer relation to ethics than to any of the other philosophical disciplines. It has, however, a certain analogy with ethics. Logic points out the way to correct thinking, ethics to right acting. Logic deals with what must be true, ethics with what ought to be done.

The relations of ethics and psychology is especially intimate. St. Thomas Aquinas recognized their close connection when he wrote: "We cannot come to a perfect knowledge of morals without knowing the powers of the mind." Certainly a full discussion of ethical problems is not possible without treating of freedom, habits good and bad, the influence of emotions on the will, and so forth. In the course of the study of these problems a certain amount of psychological knowledge must either be supposed or communicated. Consequently, for the full development of a system of ethics, psychology is absolutely indispensable. So far, however, very little ethical psychology has been written. The empirical psychology for the virtues and vices has certainly not passed the days of its infancy.

Ethics is very incomplete without a discussion of the relations of man to God. The concept of God, therefore, as developed in theodicy crowns ethical speculation with a dignity and sublimity that could not be otherwise obtained. Besides, though man's personal relations to his fellow men give a certain groundwork for the distinction between right and wrong action, the ultimate foundation of the moral "ought" does not rest upon man's relations to man but upon his relation to God. And ethics, full and perfect, therefore, cannot be developed in complete independence of theodicy.

Among the sciences outside the philosophical disciplines, anthropology, sociology and political economy are of special importance to ethics. Anthropology gives a history of the morals of primitive peoples which lays at the disposal of the moral philosopher one of his most important series of facts. Sociology and political economy give an insight into the actual conditions of the present which is indispensable for distinguishing right and wrong in the complex problems of modern life." (A Historical Introduction to Ethics, Moore, p. 3-4)

Today we are witnessing the great struggle in all parts of the world of the State as a servant to Man Vs. Man as the servant of the State. As a consequence, it is doubtful if either man or the state is being served as well as it should. People are important in a way that a state can never be important. States may come and states may go, but people must

be there first.

Interest in social problems and the individual's relation to them is keener today than ever before. Likewise, the social problems are more serious today than they were years ago.

Man, from the earliest times, has been interested in himself and his first attempts were superstitious. Human nature was explained in terms of supernatural spirits or demons. Gradually people began to distrust superstitious explanations and turned to philosophy to find the meaning of life and man's place in the world. The philosophers eventually turned to science for facts to guide them in their thinking. It soon became apparent that the study of man was too big for one science. Today we have the biological sciences, which study how man and other animals grow and reproduce, and the social sciences, which deal with cultural conditions and institutions that cause groups of people to act in a certain way. Psychology being a science which attempts to describe, understand, predict and control the behavior of people stands somewhere between the biological and the social sciences and is a part of each.

THE METHODS OF ETHICS. "The methods of scientific research may be classified under the two headings, empirical and theoretical. The empirical method deals with facts primarily and seeks by studying and analyzing them to arrive at general principles, and thence to deduce valid conclusions. Most sciences have from the beginning been predominantly either empirical or speculative. Logic, for instance, has never been an empirical science, and systematic botany never predominantly theoretical. Unlike most sciences, ethics from the earliest times has made use of both empirical and speculative methods, and even to the present day the two methods have been employed by the most modern moralists. No one can read the Nicomachean ethics without realizing that the facts of the moral life form the groundwork of the discussion. What men look upon as the end of life, is the starting point from which, by analysis and deduction, the conclusions of the Aristotelian ethics are finally drawn. If, on the other hand, one reads Herbert Spencer's Principles of Ethics he will realize that though the starting point is made in the Data of Ethics in biological and sociological facts, nevertheless the distance between facts and conclusions is bridged over by speculation. It is true indeed that, even in the admittedly empirical sciences, generalizations flow from facts making them genuine sciences rather than mere records of observation. But, even in the most empirical system of ethics, one will look in vain for that close connection between facts and conclusions that is to

be found, for instance, in a modern textbook of physics.

Notwithstanding the fact that the empirical method cannot be applied without restriction to the data of ethics, ethical systems could be classed as empirical or theoretical according as the weight of their insistence is given to the facts of moral experience, or to the principles of morality.

Beginning with Lord Shaftesbury, modern writers on ethics have all tended, more or less, to accentuate the facts of moral experience as the basis of ethical theory. At first subjective facts were accentuated, and a psychological analysis (Hutcheson and Adam Smith) became the starting point for moral speculation. Later on the importance of objective facts was recognized, and in Spencer's ethics of evolution these became the pillar and groundwork of moral theory.

No matter what the advances made in the future, one can scarcely hope that ethics will become a predominantly empirical science, like physics and chemistry. The advance in psychological method will no doubt open the way more completely to an experimental study of the will, and thereby enable us to base certain conclusions on facts which have hitherto been disputed by theorists. Philological, ethnological, and historical studies will give us a better insight into what men have considered right and wrong, but, when all that we now hope for from empirical research has been done, the relations of this life to eternity and of man to God will still remain the crowning point of ethical speculation." (A Historical Introduction to Ethics, Moore, p. 4-5)

"In ethical speculation the principal point involves the problem of morality and the obligations that it imposes. Certain actions make man feel that he is bound to do them or not to do them. Is this reasonable? On what does the morality of his actions depend? In answering this question moralists find themselves in one or the other of the two great divisions of the ethical systems, "Morality Conditionate" or "Morality Absolute." The Conditionate Morality is looked upon as having no absolute or eternal character; one ought to do the right thing if he wants to feel contented.

The chief system of conditionate morality is that which regards pleasure as the standard of right and wrong. This system in general looks upon the utility of an act for the welfare of the individual or society as the criterion of morality. Rousseau and Hobbes maintained that there is no such thing as natural law and that morality depends exclusively on the customs of society. For these reasons the school is known

as "Utilitarianism." When pleasure is made the standard of utility the system is known as "Hedonism." If pleasure or happiness of the individual is made the final end the system is known as "Egoistic Utilitarianism." If the welfare of society is the standard of right and wrong, it is known as "Altruistic Hedonism" or "Altruistic Utilitarianism." "Hedonism" is also known as "Epicureanism."

A different way of viewing morality is that which looks upon it as independent of our subjective states. We are not right because we are satisfied, but we are satisfied with our action because it is right. Instead of obligation depending upon the way we feel, our feelings flow from our manner of action. So that prior to our feelings there is something which demands that an action should or should not be done.

Moralists of this type may be distinguished by the way in which they claim that the difference between right and wrong is perceived. The difficulty of explaining the simple dictates of conscience by which right and wrong are distinguished led Hutcheson to postulate a special faculty that senses morality as sight does color. His pupil, Adam Smith, thought that this faculty was identical with the familiar sentiment sympathy.

Others, such as Cudworth, regarded the intuition of reason as the faculty by which right and wrong are distinguished; whereas to others it is nothing more than reason passing judgment upon conduct.

A full history of ethics would distinguish other systems. These, however, will suffice to introduce the ideas and various methods of reasoning of the moralists. The number of types has been limited in order not to confuse the beginner." (A Historical Introduction to Ethics, Moore, p. 5-6)

THE VALUE OF ETHICS. "Philosophy sprang from religion. It never has been and never could be a mere speculative knowledge. Religion seeks above all to direct human activity to a divine ideal. Speculation and theorizing are in some manner foreign to religious experience as we know it in our inner spiritual life. At the same time, the interior life gives rise to many problems of speculative thought, and thus religion and philosophy are connected not only by logical association, but also by psychological necessity.

Philosophy at its birth derived from religion that love of wisdom, which directs not only thought but actions to the final goal of human existence. Its real value lies in its

power of dignifying and purifying our ideals and our works.

Ethics, more than any other branch of philosophy, has preserved the original ideal of speculative thought--the direction and guidance of the acts of man. To ethics especially belongs the task of defining in speculative terms the end of human action. Its task, however, does not stop with defining and contemplating the end of man. It defines in order that it may direct. It contemplates the ideal in order that it may stimulate endeavor. It lays down laws in order that they may be followed. It is not a purely theoretical but also a practical science.

Ethics does not take the place of religion, except where religion is lacking. It does not conflict with religion, because the religious ideal harmonizes perfectly with the ethical. Ethics shows that the moral dogmas of religion are reasonable, even independent of revelation. Ethics outlines a scheme of ends which religion fills in with living color.

He, therefore, who studies must bear in mind its practical value. He must seek above all a living standard of life, a rule of action that he is ready to adopt, an end towards which he will tend consistently ever after." (A Historical Introduction to Ethics, Moore, p. 9)

Paraphrasing some remarks made by Madeline O. Holland in her paper to the Conference of Secretaries in Miami and published in the National Capitol Pharmacist, June, 1955, p. 63, she said:

"There was a period in the history of pharmacy when the need for a course in ethics and professional relations would have been considered absurd, unnecessary and a direct reflection on the pharmacists. This period as you well know was before World War I when pharmacy, or more precisely, the drug store, was in most cases and in most places more definitely and more closely related to the problems involving the public health and the care of the sick. The respect and the deference shown the pharmacist was equal in all respects to that shown the physician. The pharmacists of that period placed great emphasis on professional matters and they organized themselves into groups of various kinds so they might practice more effectively their professional calling. A perusal of earlier pharmaceutical literature will reveal the emphasis that was placed on professional matters. These pharmacists did not feel the necessity to defend their professional status or to be in doubt about their actions which concerned matters involving ethics or professional relations."

After World War I, pharmacy became involved in many merchandising situations where its services were either necessary or were considered necessary, and once started on the road to extensive commercialism there seemed to be no end. We can pass quickly over a few of these situations which led to the lowering of professional dignity such as the Volstead Act, the economic crisis of 1921 to 1935, the growth of chain drug stores, the search for outlets by producers and the inadequate laws to protect the professional practices of pharmacy, plus the tardiness of pharmaceutical education to raise its standard to parallel those of other health groups and other sciences.

When drug store owners decided to market many side lines foreign to the accepted inventory of a drug store they placed themselves in direct competition with non-professionals and naturally they would have to abide by regulations governing the tradesman. All of these activities created situations the solutions to which will require sound reasoning and study to arrive at valid conclusions.

Since there is literally no ethics in the general run of ordinary business, it is not unusual that the drug store owner will find himself beset by problems where he should have a sound knowledge of ethics and professional relations to help him solve his problems.

Today we are aware of the growing interest in problems involving ethics and public relations in pharmacy but we have few standards, insufficient urge, and no textbooks to show us the way to logically, justly, and morally solve most of these problems for our profession.

The need for proper instruction in ethics and professional relations is evidenced by the numerous references in the medical and pharmaceutical press. The definite need for ethics can be readily discovered if one will listen to the questions which are asked about what is right and what is wrong in certain actions; should a pharmacist do this or refrain from doing something else; who will store and sell drugs; has the pharmacist a right to class himself as a professional man if he performs few services which should be classed as professional; should pharmacists report violations of the law by their competitors; is counter prescribing justified if physicians dispense and operate clinic pharmacies; is emergency treatment by pharmacists justified; euthanasia; birth control; sale of abortifacients and contraceptives; sale of products produced with tax free U.S.P. alcohol; types of advertising used by pharmacists; socialized medicine; permitting friendly physicians to look through your prescription file; establishing

the price you charge for prescriptions; fair trade; fee-splitting; working in clinic pharmacies; sanitation and cleanliness of the pharmacy and the personnel; failure to check inventory for deteriorated drugs and medicines; substitution; lying; special formulas; private language for certain physicians to direct prescriptions to your store only; gambling; drunkenness; drug addiction; viciousness and gluttony; respect for organizations; adequate capital; charitability; proper science training; and legal responsibility.

This is by no means a complete list of the problems, situations, or incidents that face modern pharmacy, but it is large enough to focus attention on the need for some procedures or instruction that will assist in the solutions or help us to arrive at just and logical conclusions.

The practitioners of pharmacy have from remote times assumed their obligations in the matter of health and treatment of the sick. For a long time one could not separate religion, medicine, pharmacy or superstition, but in time the separation as distinct groups occurred. Pharmacy continued to follow the method of the preceptor, to master the skills and gain the "know how" but not the "know why." Other science groups developed out of this Medico-Philosophical-Pharmaceutical Triumvirate and they advanced, added to their knowledge, and grew strong in favor and prestige but they did so only by alliance with liberal education and its courses. Most of these groups wished to have the prestige of being professions and at present we find all manner of groups broadening their education in order that they may be called professionals.

"A profession distinguishes itself from a business only by the dignity of character which its practitioners bring to the performance of their duties. The arrogation of the title "profession" by certain vocations is viewed with alarm by many persons who seek a sharp definition that will serve to cut these claimants off from the title. It should be obvious that definition alone will not accomplish this purpose. The best way to make such distinctions clear is to insure that the genuine professions demonstrate such a consistently high order of professional behavior that finally every inappropriate assumption of the title will appear inept, ludicrous, and the unqualified will struggle to achieve genuine profession or retire from the field." (Annals, American Academy of Social and Political Sciences, January 1954, p. 110)

A moral code can be justly said to be real basis of professionalism.

Abraham Flexner in 1915 proposed six criteria to be fulfilled before one could be called a professional. Flexner was Director of the Rockefeller Institute and later in 1930 Director of the Institute for Advanced Study at Princeton. It is claimed that Flexner did more for medical education than any group of medical men ever did for themselves. I strongly recommend his books, "I Remember" and "Medical Education."

The six criteria proposed are:

1. Intellectual operations coupled with large individual responsibilities.
2. Raw materials drawn from science and learning
3. Practical application
4. An educationally communicable technique
5. Tendency toward self-organization
6. Increasingly altruistic motivation

With this same thought in mind I especially refer you to the January 1954 Annals of the American Academy of Social and Political Science which is devoted to the ethical codes of all recognized professions and certain other useful information dealing in the realm of ethics.

After reading those I wonder if you would agree with this statement. "Pharmacy as a whole is deficient in its interpretation of the fundamental principles that mutual respect and understanding is virtually necessary for the improvement of the profession."

Perhaps we might consider the above in light of our present thinking and ask ourselves--Why have our colleges of pharmacy been so long in delaying the adoption of sufficient courses in philosophy and failing to give proper and sound guidance in ethics?

Granting that pharmacy is both a professional and a scientific course we can safely say that the content of the various courses is no longer rough, unanalyzed knowledge but most of it is practical--some is constructive and some is theoretical. The introduction of additional courses into a curriculum must undergo careful scrutiny and evaluation in order to place them in one of the three stages of science. Ethics can be classed as a practical science while professional relations would be merely the following-through of good sound ethics.

The Revised Tentative Fifth Edition of the Pharmaceutical Syllabus of 1945 on pages 13 to 15 presents an outline for a course in ethics but the fulfillment of that outline to do a

good job would require six hours for two semesters. That outline would need the guidance of an expert teacher well trained in philosophy and theology. A good textbook on general ethics and one on special ethics would be necessary to cover the topics listed. Likewise, a considerable amount of outside material would need to be included and outside readings assigned from a good library source.

The report of the Committee on Curriculum of the A.A.C.P. presented at the Miami Beach Convention on May 1, 1955 by Chairman Lloyd M. Parks stated, "It is the duty of the school to direct student thinking in the area of professional ethics, attitudes, and manner of conduct so that he may develop an ability to weigh the issues he will face in his daily work."

I do not agree that ethics should be combined with other courses such as Pharmaceutical Law or History of Pharmacy or Pharmacy Orientation courses. Likewise, I do not believe that ethics should be in a beginning course. It should be taught after other courses, preferably as a senior subject. Ethics is the foundation from which we develop professional relations. The history of pharmacy is so rich and so full that it needs all the hours that can be spared for its study. Likewise, pharmacy law is a special topic and in no way should be combined with other courses if the student is to master the basic concepts of law.

The Proceedings of the Teachers Seminar on Pharmaceutical Education, 1954, pages 161 to 164 contain the experience of Sonnedecker, Clark, and Kaufman in teaching ethics to pharmacy students.

Kaufman, in his paper "Ethics for the Pharmacy Student, "A.J.P.E., 17-225-1953. stated, "There is no simple solution to the problem of teaching ethics." In this I will heartily agree.

Again, Kaufman, in his paper "Teaching Professional Ethics," A.J.P.E., 18-255-1954, stated, "The colleges of pharmacy are partly responsible for the low state of ethical observance in pharmacy." Again, we can conclude that this statement agrees with out thinking.

Kaufman continues: "We at Butler feel strongly that the teaching of ethics is a four year task." We do not agree, but a good sound theology background and other courses in philosophy could prepare the student for one full semester of three hours per week for ethics, special and general. However, every teacher should take advantage of the opportunity

to stress the importance of ethics and the fulfillment of these ideals in pharmacy.

Blauch and Webster in THE PHARMACEUTICAL CURRICULUM, (American Council on Education, Washington, D. C., 1952, p. 163-164) state "From a course in ethical and professional relations the student should obtain (1) understanding of the need for, and the basis of, ethical conduct, including his special obligations as a pharmacist and (2) a desire to render his professional service in accordance with ethical standards."

They suggest 32 hours of didactic instruction with two hours of credit. Our experience has been that piece-meal education in ethics will not satisfy the needs for pharmacy. The absolute minimum would be three credit hours a semester provided the student has some previous courses in philosophy.

#### SUBJECT MATTER OF A COURSE IN ETHICAL AND PROFESSIONAL RELATIONS (See Blauch and Webster, page 164)

"Ethics cannot be summed up in a series of inviolate rules or commandments which can be applied everywhere and always without regard to circumstances, thought of consequence, or comprehension of the ends to be attained. What is universal is the good in view, and ethical rules are but the generally approved ways of preserving it. The rules may clash with one another, and then the only way is to look for guidance to the ideal. Every profession has its own problems of conduct, in the interpretation within its own province of the common principles of ethical conduct. Out of such situations develop the written and unwritten codes of professional ethics." (Social Significance of Professional Ethics, R. M. MacIver, Annals, American Academy of Political and Social Science, January, 1955, p. 120-121)

In my long and varied career in pharmacy there have been many situations and many problems, some serious and others less grave, that have been solved, but the solutions were made possible only because of my special studies in the fields of philosophy. Consequently, I feel qualified to discuss ethics in a general way and apply the principles learned from studies in Psychology, Logic, Ontology, Theodicy, Metaphysics, and Ethics. Likewise, I believe I know what a student should be required to take in the area of Philosophy if he is to reap the greatest benefits from his college career. Nevertheless, what I have just stated does not qualify me to tell you what to teach to make a student more aware of his ethical responsibilities, or how to teach the subject material involving ethics. It is one thing to know how to use material learned,

but it is a more difficult task to teach it.

At our University we have had enough experience in the field of philosophy to realize that the student cannot take one or two courses in philosophy and end up with sufficient knowledge to satisfy our requirements. We solved the problem and protected the student by making it obligatory that he take these courses: Logic, Metaphysics, Psychology, and General and Special Ethics. I am happy to tell you that it is most satisfying and most successful. The results of this training are bringing many benefits to pharmacy in our state.

The method used to teach ethics at our University is the scholastic method in which the thesis is first stated, then the terms of the thesis are defined and explained and a proof of the thesis is added.

The instructor usually has his own mimeographed set of lectures. The student purchases this at a nominal price and he is also required to have a textbook. The book used is General Ethics by Rev. Joseph J. Sullivan, S. J., and another text by the same author is used in Special Ethics.

Outside readings are given at intervals, examinations are held at mid-semester and at the close of the semester. Quizzes are used at the discretion of the instructor.

Students are encouraged to present problems and problems in the book are handled in class by the student.

The classes meet three times a week and the credit is three hours per semester.

We are fortunate in having faculty members who are well trained in Theology and Philosophy and whose teaching is confined to these areas. The pharmacy students take these courses in the College of Arts and Sciences along with other students enrolled in the various university programs. At first they do not relish these assignments but gradually find themselves liking the courses. It is not unusual for graduates to write and tell us that philosophy has helped them as much as any course they ever took and they are certainly glad they were required to take such courses.

In 1935 we realized that pharmacy students needed courses in psychology, logic and ethics but our curriculum would permit time only for one course. We enrolled the students in the College of Arts and Sciences to take General and Special

Ethics for six hours. After the close of the session the professor, a nationally known philosopher said to me, "Dean, we cannot admit your students for ethics after this year. It is unfair to them to make them try to master this course when they have no foundation for it. Unless they can take at least Psychology and Logic and preferably include Metaphysics and Theodicy, they are not fully prepared to reap the rich harvest which Ethics has in store for them. Pharmacy students do need a complete course in Philosophy because of the nature of their profession." Since then I have realized the wisdom of this advice and as soon as we could adjust our curriculum we gave thought to the present program.

In 1948 we made Philosophy obligatory and the pharmacy students in the sophomore year took eight credit hours and in the junior year eight more credit hours of Philosophy which embraced Ontology, Cosmology, Epistemology, Dialectics, Psychology, Theodicy and General and Special Ethics. In 1951 we revised and defined our courses. The sophomore took Logic and Metaphysics, six hours; the juniors took psychology, three hours; and the seniors took General and Special Ethics, six hours; for a total of fifteen hours. In 1954 with the adoption of a pre-Pharmacy program of two years the student is required to have twelve hours of philosophy, three of which will be in the junior year in General and Special Ethics.

Our actions in this respect therefore indicate our realization of the value of these courses to pharmacy students and we hope that all colleges of pharmacy will realize as we have that pharmacy needs these courses more today than ever before.

In preparing this paper I had to draw heavily on numerous writers in this field mainly because it is very difficult to express certain basic ideas about ethics in a variety of ways and still keep the concepts, theses and facts clear and orderly. Likewise, not being a theologian or a teacher of philosophy it would be presumptuous on my part to expound these theories based on my own limited training in the field.

The previous seminars held under the joint auspices of the American Association of Colleges of Pharmacy and the American Foundation for Pharmaceutical Education have certainly been of inestimable value to pharmacy. They have been a contribution of such magnitude that their benefits will flow on into the future so that pharmaceutical education will be the richer and our future pharmacists better professional men, better citizens and render a better service to the public.

## TEXTBOOKS--ETHICS

Almost every university library will have a number of textbooks on history of economics, economic developments, morals, ethics, religion, conduct, metaphysics, logic, psychology and public and personal relations. The teacher of ethics should familiarize himself with those references which best meet the needs for his particular type of course.

I have selected the following textbooks because they are very clear, brief, and well written expositions on the subject of ethics. Many of these textbooks have problems for study and some have questions for each chapter.

- Principles of Ethics--Moore, Lippincott Co., 1935
- \*A Historical Introduction to Ethics--Moore, American Book Co., New York, 1915
- Ethics--Dewey and Tufts, Holt, Rev. Ed., 1936
- A System of Ethics--Paulsen, Scribner's, 1903
- A First Book in Ethics--Woods, Joseph F. Wagner, Inc. N.Y.
- \*Science of Ethics--Cronin, Benziger Bros., Vol. II, Special Ethics, 4th Impression, 1939
- \*Five Types of Ethical Theory--Broad, Humanities Press, 5th Impression, 1950
- \*Readings in Ethics--Leibell, Loyola U. Press, Chicago, 1926
- Ethics and Social Policy--Leys, Prentice-Hall, 9th Printing, 1951
- \*The Annals Journal--Ethical Standards and Professional Conduct, American Academy of Society and Political Science, 1955
- \*Moral Philosophy--C. Coppens, Schwartz, Kirwen & Fauss, New York, 1924
- \*Elements of Ethics--C. Miltner, McMillan Co., 1925
- \*Special Ethics--Jos. F. Sullivan, Holy Cross College Press, Boston, 6th ed., 1947
- \*General Ethics--Jos. F. Fullivan, Holy Cross College Press, Boston 8th Ed., 1949
- \*A History of Economic Ideas--E. Whittaker, Longmans Green Co., 1940
- \*Summa Theologica--St. Thomas Aquinas

I am not sure whether it was the Library Committee of the American Association of Colleges of Pharmacy or whether it was Dr. C. O. Lee of Purdue University that compiled a booklet (mimeographed) of material from pharmacy libraries of subjects involving ethics. The list covers 695 references and the title is: History and Ethics - Pharmacy 31.

I have omitted some references of books on Deontology

and Ethics in pharmacy which are written in Spanish, some in French and others in German. None of them are translated into English. If the reader is facile in languages these sources are also recommended.

Sheets listing the following discussion problems were distributed by Dean McCloskey.

A customer of yours purchases excessive amounts of cosmetics and cautions you not to put them on the bill as her husband gets angry. She says she will arrange payment and asks you to list the cosmetics as cough syrup, etc. What is your obligation?

A married customer of yours comes in your store almost daily just after her husband leaves for work. She uses the telephone and soon thereafter you see her get in an automobile and ride away. The husband is a good customer of your store. Do you have any obligations in this case?

A housewife, with three children, comes into your store and plays the slot machines, pin ball machines, etc. and spends excessive amounts. Sometimes she borrows a few dollars from you until pay day and uses them in the machines. Is this any of your business?

Mary Smith wants to purchase two dozen five grain Quinine Sulfate capsules and a stick of slippery Elm bark. Will you sell them?

Dr. X continually telephones narcotic prescriptions to you and promises to send the prescription to you. Most of the time you have to go to his office to get them. What is your obligation?

In pricing your prescriptions you do not follow any special plans. You charge whatever you think you can get. You think pricing schedules are wanted by the "big stores" because their overhead is higher than yours and they can't meet your prices. Is the question moral, ethical or legal?

I have a prescription for Fairchild's Essence Pepsin and do not have it. Instead, I compound the prescription using an equivalent official product. Is this moral, legal or economic?

A certain hospital has many stock formulas listed by numbers and frequently doctors write prescriptions only with the number. Many times these prescriptions come to your drug store but the hospital pharmacist refuses to disclose the

formulas. What can you do?

You follow a policy of giving secret rebates to some of your (a) customers and (b) you send a check every month to a few physicians who direct prescriptions to you. What problems are involved?

You have only a limited amount of cash and a limited amount of credit. However, you decide to open the drug store you have purchased knowing that the odds are against you. Should you open the store and why?

A customer of yours asks you about the ability of a certain doctor. You don't like this doctor. What should you say?

A pharmacist knows that a man with a social disease intends to marry his very good friend. What course of action do you suggest?

"I cannot see anything wrong in telling a 'White Lie.'" Comment upon this.

A good natured pharmacist obliges his customers by compounding prescriptions that do not have the signature of the doctors. Comment upon this.

For economy's sake the pharmacist substitutes drugs knowing, of course, that the patient will not suffer any harm and be better off economically. Is this procedure excusable?

Miss Brown has committed a grave sin with John, a friend, and finds herself with a child. In order to avoid the disgrace of giving birth to an illegitimate child, she takes an abortifacient medicine, justifying her action by this: the potion will have several good effects, namely saving her reputation and not burdening the state asylum with the child; she also realizes the evil effect of causing abortion. Was Miss Jones justified in her act? Was the seller of the abortifacient guilty of anything?

#### Problems That Sound Ethics Can Solve

I can't sleep. I need rest badly. I wonder if I should take a pill to make me sleep. I took the pill and I didn't feel badly at all when I awakened. It truly did me good. I, of course, won't get into the habit.

A senior pharmacy student has been working in a drug

store since he was a high school student. His boss, the pharmacist, now takes full afternoons off and once in a while is gone all day. He tells the student that he is well trained now and can handle most of the problems but if he cannot just call his friend Mr. X to help. Is the student justified in accepting this responsibility?

Dr. X, a good prescriber for the drug store I work in, telephones narcotic prescriptions in to us. I have told the store owner, a pharmacist, that I cannot violate the law like this. If I don't answer the phone and take these orders I will lose my job. What can I do? What should I do? Should I report this to the Bureau?

We do not have the brand of tablets required on the prescription and the head pharmacist orders me to use a substitute brand. What are my obligations?

A good customer of the store comes in and asks me to prepare some medicine "for pains in his back." He refuses to take packaged medicines. The proprietor tells me to give him some of that medicine in the big bottle and label it "For Pain in Back." Should I refuse to do this?

Older people seek out immoral books and go to immoral plays. After some of these actions they get involved with the civil authorities. Are these older people responsible for the consequences? (Consumpiscence) - (Consequent)

Bill has an old, invalid, and rich uncle. The uncle has three living relatives. Bill is the only one who has taken care of the uncle and he threatens to leave him unless he makes out his will to Bill as sole beneficiary. Could this will be broken? (Fear, Grave)

In closing the drug store one night you found a purse with a sizeable sum of money in it. No one came to claim it. You didn't look in the lost and found ads in the paper. Is your conscience clear when you keep this purse? (Conscience)

I make a contract with a demented person because I do not know that by law such a contract is invalid. Can the contract be fulfilled? (Ignorance)

I make a contract with a demented person and only after the contract is made do I discover his illness. Can the contract be fulfilled? (Ignorance)

You are a moderator of a society. It holds an election

which is tie. During the counting of votes another member comes in. You allow him to vote. His vote is the deciding one. The losing side blames you for letting him vote. Are you responsible? (Ignorance)

Mary, a rich young lady and heir to a large fortune, was forced into marriage unwillingly by her mother who positively forbade her to see other young men. Mary was threatened to be disinherited, was practically locked up in the house and the mother threatened suicide if she didn't marry the selected young man. Mary was of a timid disposition, was very unwilling to marry the young man but finally did so to avoid trouble. Was this marriage a valid one? (Fear-not voluntary act)

John frequently makes use of profane language and pleads that he is not responsible because swearing is now a habit for him.

Peter, a boy of twelve, was dragged by his drunken father into a store and forced to put his hand in the cash register and take out the money. Was Peter guilty of theft? (Fear)

Thomas, a young boy of fourteen, was ordered by his drunken father to steal ten dollars from a store. He was caught in the act and pleaded that he was not guilty since the fear of his father caused him to take the money. Was Thomas guilty? (yes)

I am compounding a prescription and begin to have doubts as to the safety of the dose of the finished preparation. I do not want to call the boss for fear he will think I don't know, so I take it for granted that if the doctor wrote it, it must be safe. Next day the patient became very ill, later sues the boss. Who is guilty and why? (Vincible Ignorance)

#### UNETHICAL PRACTICES

In the promotion of the drug store we see signs like these:

"CUT RATE"  
 "FRESH DRUGS"  
 "PHARMACIST ALWAYS ON DUTY"  
 "ETHICAL PHARMACY"  
 "PRESCRIPTION FILLED EXACTLY AS WRITTEN BY YOUR DOCTOR"  
 "PRESCRIPTION SPECIALISTS"

Also under-pricing prescriptions compounded by another pharmacist.  
 Giving fairly expensive Christmas gifts to certain prescribers.

Should a pharmacist purchase, promote and sell products such as "Hadacol" when he realizes they are high priced and promoted by deceptive and misleading advertising?

Discussion: Dean McCloskey was asked if he believed it possible to teach ethics to students who have no moral or religious basis on which to build. It was answered that the student must have a background to understand his conscience and to have a broad concept of what is better for his fellow man.

#### Summaries of Workshop Sessions

Thursday, August 11

##### Section A: Dispensing Teachers

Reported by C. V. Netz, U. of Minnesota

The group was in agreement that the dispensing course was a place where all of the previous knowledge, especially the fundamental principles of the various sciences, is tied together into a meaningful end. We discussed many ways for teaching the laboratory work in prescription compounding. We also discussed the teaching of incompatibilities. We seemed to be in agreement that there are a variety of ways of teaching the prescription compounding course. The method used by any one teacher or college would have to depend on the setup of the college and curriculum and on the staff concerned. Since the last Seminar of teachers of pharmacy six years ago, there seemed to be a trend toward less emphasis in the prescription compounding course in the teaching of trade names. We also went into the construction of laboratories. We were in general agreement that the effectiveness of the teaching would depend on the methods used, the aids, and the equipment available.

##### Section B: Hospital Pharmacy and Hospital Pharmacy Administration

Reported by Herbert Flack, P.C.P.&S.

We were of the opinion that one value of including hospital pharmacy as a required course is that it would benefit the retail pharmacist located in the city where there is a small hospital but no hospital pharmacist. It was interesting to note that the University of Washington has accepted some candidates for the Master of Science in Nursing degree into their senior courses in hospital pharmacy administration. In the hospital administration lectures it was recommended that

the lecturers of the course be asked to explain the operation of their department and its relationship to the pharmacist and to the hospital as a whole. It was agreed that there should be an introductory lecture early in the professional year on hospital pharmacy plus a couple of field trips to give an introduction to hospital pharmacy practice. Certain electives such as sterile products manufacturing, medical and surgical supply manufacturing, radioisotope laboratory, and possibly pharmacy administration should be made available. Mention was made of a project undertaken at Purdue. Certain students were sent into the state hospital pharmacies, to evaluate them and to see how their practices could be upgraded. An actual inventory was taken in each of the hospitals in many cases, for the first time. This was a one-year project carried out in cooperation with the State Board of Pharmacy

#### Section C: Manufacturing Pharmacy

Reported by H. P. Bowmann, U. of Iowa

We felt that we need a more definite nomenclature for some of the courses. A lot of suggestions were brought out as to how this course could be improved. No real general conclusions were drawn except possibly that the course should be given as an elective. It should deal primarily with the process of manufacturing preparations regardless of the size of the batch, regardless of whether or not the school has an outlet. Due to the fact that there is so much similarity, it was felt by some that in future meetings of this kind, the hospital pharmacy and the manufacturing pharmacy groups should be combined.

#### Section D: Ethics and Professional Relations

Reported by J. F. McCloskey, Loyola University

We were of the opinion that there is an increasing demand for more emphasis on ethics. It was felt that if it must be combined with another subject, it should be combined with history. Ethics should precede law. We were of the opinion that the title should not be ethics unless it were a separate formal course. We were of the opinion that we do not have the qualified teachers to do the job in ethics. Out of it came the suggestion that probably it would be a good idea that a short course--2 weeks--might be held where some of the people in this field would present material on this subject to teachers who would use it in our colleges. It also was brought out that if such were impossible, we could have the teachers who are

participants in this subject take the courses given on their own campuses. We believed that the minimum amount of 2 hours per semester was necessary. We came to the conclusion that everyone in pharmacy could make a realistic approach to ethics and use and apply the principles thereof. In professional relations, we came to the conclusion that it was so closely allied with ethics that it depended primarily on a good foundation in ethics. We also brought out the difference between a professional's contact with professional people and a professional's contact with others who were nonprofessional. That is quite important when we consider professional relations. There is very little difference between professional relations and public relations. There was considerable stress put upon a pharmacist's cooperation with other members in his own field. We believed that the schools should have some way of making the pharmacist realize that he is a professional man and that he should shoulder his responsibility.

## MORNING PAPERS

FRIDAY, AUGUST 12

K. L. Kaufman, Presiding

## RECRUITMENT FOR GRADUATE STUDY IN PHARMACY

Linwood F. Tice, President

American Association of Colleges of Pharmacy

At the very outset, I wish to explain that I am not speaking on the subject of the recruitment of graduate students because I feel pre-eminently qualified to do so. When I was asked to speak on this subject by the Seminar Committee, I explained my limitations and it was only through their insistence that I agreed to accept this assignment.

I cannot speak as one who has done an outstanding job of recruiting graduate students, but I have observed the success of many who have led young men into a career of scientific achievement. I also have had the experience of seeing my own son follow this pathway, for he is now enrolled as a graduate student in one of America's large universities.

One cannot conceivably manifest an interest in graduate study unless his attitude toward learning and scholastic

achievement is healthy and sound. This, unfortunately, is not the attitude of vast numbers of our undergraduate students-- not only in colleges of pharmacy, but in all institutions of higher learning. I am a firm believer in the primary influence of one's early training in the home in determining much of what an individual is, what he strives to be, and what he accomplishes. Of course, intelligence is a prerequisite to scholarship and this is influenced only to a small degree by one's early environment, unless we consider such factors as proper nutrition and so forth. The early environmental factors, we as teachers cannot influence greatly, but it would be foolish for us to overlook them. It is our duty as parents, and as friends and associates of other parents, to keep them constantly in mind. It is my firm conviction that a child's attitude toward study and scholastic endeavor depends very much upon the introduction to such things which begin with his early home training. As soon as a child comprehends words, reading can be made for him a pleasant experience and books can become things of joy. All this depends largely upon the mother and father, for it means long hours spent in reading to the child even before school age has been attained. Books become open doors to the wonderful world in which the child lives and he approaches their pictures and the words explaining them with eager interest. It is assumed, of course, that that which is read to the child is scaled to his proper level of perception and does not consist largely of comics and horror stories so popular among America's almost illiterate adolescents. A child properly conditioned by his mother in the home enters school with a love of reading and a desire to learn without which the teacher is greatly handicapped. The attitude of parents toward teachers and other learned men is also reflected by the growing child. If they are considered queer and subject to ridicule, no child will hope some day to emulate them. Respect for learning is often inculcated in children by parents who themselves were unable to obtain proper schooling. In so doing, they have almost assured progress by the child in school.

I think it important to pause here long enough to reflect that the all-too-common practice whereby mothers work to increase the family's purchasing power for luxuries and gadgets is inconsistent with the proper early conditioning of the child of which I speak. The impact of this on American society has yet to be fully appreciated, but it is inescapable.

Next in the chronological order of things is the influence which a certain few outstanding teachers have on a child during his early school years. Here, again, it is unfortunate that some teachers actually do more to destroy a child's

desire for knowledge than they accomplish. Were it not for a few dedicated souls in our elementary schools, things would be even worse than they are.

The all-too-popular system of progressive education exacts its toll because students of greatest capabilities are discouraged from doing their best, since it is totally unnecessary to work hard to attain the highest grade. The result of this system is a tremendous waste of intellectual power and it explains why so few students graduating from our high schools are really prepared for the rigors of college life. The vast majority simply do not know how to use their brain power; like an arm kept for weeks or months in a sling, it has no strength. The result is that the task of recruiting suitable graduate material is made even greater than it would need to be.

We do find in our secondary schools, here and there, a teacher with understanding and vision. Usually he will be found to be a science teacher or a mathematics teacher who himself had the opportunity to understand what scholarship means and the satisfaction and joy which it can bring. Such teachers do not go about their work simply as a means to an end but they spend considerable of their free time in directing the bright young minds coming under their purview into proper channels. With great skill and patience, they challenge their most capable students with extracurricular assignments into some realm of science. Together, they build some intricate piece of equipment or they seek to identify some unknown specimen and, gradually, there dawns on the fortunate young student in whom they have shown interest the vista of the full potentialities open to one who wishes to dedicate himself to a life of science. He begins to doubt the philosophy he may have acquired—that "success in life can be measured solely by financial gain." He realizes that he is happiest when he is working on some project in which he is interested and that he, in truth, derives more satisfaction from this than from the more common pleasures enjoyed by most of his fellows. Thus is the future scientist born and, the earlier this realization comes, the more likely his future success in scientific and scholarly accomplishment.

One of the weaknesses which we in Pharmacy have suffered for years is the fact that too often the young recruit entering the field of Pharmacy does so because it appears to open great opportunity for financial return rather than for scholastic achievement. Such students engage in their studies largely for the ultimate purpose of entering a business activity which will be highly profitable. I think it not to

be unexpected that we in the colleges must search rather carefully for those who are to be the pharmaceutical scientists of the future.

The next opportunity in the recruitment of graduate students comes in the type of admissions test given those who apply for entrance to our undergraduate schools. There are still those who labor under the misconception that a good salesman and one who is an excellent counter-man in a drug-store makes the best material for the study of Pharmacy. While such attributes may be helpful to the individual in the retail practice of Pharmacy under certain conditions, they have little or no bearing on the ability of the student to do the work required by the college of Pharmacy. In truth, the admission of large numbers of such individuals has a negative influence for they detract from the accomplishment of those in the class who do have proper scientific aptitude. If we are not careful, we are likely to have the same system of progressive education at work in our colleges which has already taken its toll in the public school system.

One of the objectives of every course in Pharmacy Orientation should be to enlarge the perspective of every entering student concerning opportunities in Pharmacy and the opportunities for pharmaceutical scientists. This can be a very stimulating experience for many of the students may know nothing about Pharmacy at all except what they have seen in a retail drugstore. At the same time, it must be fully explained that to work as a pharmaceutical scientist one must have training beyond the bachelor's degree. It must also be explained that the undergraduate record is a very large factor in determining admission to graduate school since graduate work must not be considered just an extension of the undergraduate training, but training reserved for those who are unusually accomplished. In the several undergraduate years which follow, every teacher has an obligation to be constantly on the alert for those students who, by reason of exceptional ability, may be considered as potential recruits for advanced study. Here, the same technique used by the high school science teacher brings results. Such students should be encouraged to do little extra things, to investigate some problem, to look up the original research on a subject in which he is interested, to be invited to sit in for a period in graduate seminar, to be praised and encouraged for his unusual achievement. All of these things stimulate the student and it is almost a natural result that he or she will begin thinking of work beyond the undergraduate level.

Next, the teacher must avoid a common pitfall--it is all

too common to encourage the young person interested in graduate work to study on his own campus for the benefit to the teacher, the department, and even the college of having the student do this may be considerable. No teacher, if he is true to his profession, should place the student's welfare second to his own or even to his institution. I think it unnecessary to state that it is extremely unwise in most instances for a student to take graduate work in the same school where he has been an undergraduate. The counseling and assistance given by our teachers in placing their most capable students in other institutions is extremely important and, here again, one should not play favorites. Students should be advised to go where, in the teacher's honest opinion, he will get the very best training for which he is suited. I see no reason at all why a teacher who is honest with himself should avoid making a comparison of the relative merits of different schools. A student has a perfect right to expect honesty from his teacher, just as a teacher has a right to expect integrity from his student.

There is another thing which has a very important influence on the decision of young people to engage in graduate study. This is the attitude and the outlook of their own teachers who have followed such a pathway. If they see in their teachers men and women who seem grossly unhappy, sour on the world, disillusioned, or apathetic, it is not likely that they will be interested in pursuing a similar career. Those teachers who have enthusiasm and dedication, and who are able to convey to their students that joy which comes to those who labor in the vineyard of science, will not lack for disciples to follow in their footsteps. It is surprising, yet true, that good students place these things far above the acquisition of the world's goods in importance. On the other hand, I do believe that our teachers deserve and must have better pay for their services than is generally the case. It is difficult for one to maintain a sense of self-respect if his services are so poorly thought of that his resulting poverty is manifest to all.

In summary, then, there are many influences affecting one's eventual decision as well as his ability to pursue graduate study. These begin, as I have tried to explain with the young, wide-eyed child sitting on his mother's knee and learning some little of the great world about him. In the final analysis, the determinant is the missionary work done after this by dedicated teachers who themselves have a love of scholarship and an understanding of its rewards. It is easy for those who believe in something through and

through to convince others of its worth. If we ourselves are not so convinced, the task is well-nigh hopeless.

#### RECRUITMENT OF GRADUATE STUDENTS

Louis W. Busse

University of Wisconsin

During the period I spent in preparing this paper, the thought came to mind that "the recruitment of students" whether graduate or undergraduate, professional or non-professional, was almost the direct result of the awareness of the need for persons with a particular training on the part of the persons concerned with the field. It became increasingly clear that the successful recruitment of graduate students in pharmacy would be dependent entirely upon the awareness of the urgent need for people of this training on the part of pharmaceutical educators and other members of the profession--and similarly dependent directly upon the amount of effort and enthusiasm exhibited by the members in encouraging, and urging our young people in pharmacy to continue their field of specialization.

In preparing myself for this discussion I spent considerable time reading the report of the Commission on Human Resources and Advanced Training as published in the text "America's Resources of Specialized Talent" by Dael Wolfle. In chapter VI headed "The Potential Supply," I was impressed by the following analysis as applied to society.

"A society which permits a significant portion of its members to work at levels below their capabilities is failing to achieve its potential strength. The ability of a society to progress, the ability to better the goals for which it strives, and the skill and wisdom with which it meets its challenges are likely to be decisive factors in determining its fate. The goals of a free society are determined by its members, and the wisdom of the society is the wisdom of its members. Thus a society can attain its full potential only when each of its members is enabled to contribute as fully as his individual abilities permit."

I was impressed by the appropriateness and the significance of this philosophy when the word profession is substituted for society and we keep in mind we are talking about the pharmacy profession.

A profession which permits a significant portion of its

members to work at levels below their capabilities is failing to achieve its potential strength. The ability of a profession to progress, the ability to better the goals for which it strives, and the skill and wisdom with which it meets its challenges are likely to be decisive factors in determining its fate. The goals of a free profession are determined by its members and the wisdom of the profession is the wisdom of its members. Thus a profession can attain its full potential only when each of its members is enabled to contribute as fully as his individual abilities permit. It behooves all of us, therefore, to give of our time, energy and effort to encourage and inspire as many of our capable young pharmacy graduates into graduate work as is possible.

In discussing the encouraging of students to enter graduate work, (you will notice I purposely now avoid the use of the word recruitment) and so to increase our numbers in the graduate schools there are three factors to discuss: 1. the source of supply and its potential, 2. the student's own desire and 3. financial support.

1. The source of supply and its potential will vary depending upon whether we limit our source of supply to those students graduating from pharmacy schools only or whether we open our facilities to all graduates of the areas which would yield the necessary background in the supporting sciences upon which pharmacy is based. I will not argue the validity of either approach at this time for I know there are good arguments on both sides. For our discussion today I would like to discuss the source of supply from the restricted sense and estimate our potential.

It had been estimated by the Pharmaceutical Survey that pharmacy schools would be graduating approximately 4,000 to 4,500 graduates from 1950 on. I believe we did reach this figure but are below it at the present time. We should be able to assume that a certain percentage of each graduating class will go on into graduate work. I like to use the figure 10%, as a good round figure and I am firmly convinced that the top 10% of our graduating classes should go into graduate work. On this basis, for example, in 1948-49 we had 3,900 graduates and 335 students in our graduate schools of pharmacy. I believe in these later years our graduating classes have reached as high as 4,500 and enrollment in our graduate schools has gone up accordingly to around 500.

The following figures are the predicted college enrollments.

(1) Projected High School and College Graduates.

<u>Year</u>	<u>High School Graduates</u>	<u>College Graduates</u>
1954	1,274,000	286,000
1955	1,327,000	272,000
1956	1,396,000	283,000
1957	1,400,000	288,000
1958	1,475,000	292,000
1959	1,582,000	307,000
1960	1,777,000	326,000
1961	1,873,000	329,000
1962	1,801,000	350,000
1963	1,778,000	378,000
1964	2,155,000	427,000
1965	2,446,000	454,000
1966	2,364,000	439,000
1967	2,401,000	437,000
1968	2,416,000	532,000
1969	2,583,000	608,000

(1) America's Resources of Specialized Talent, Page 171.

It is quite obvious from these figures that undergraduate pharmacy school enrollments will reflect a similar percentage increase in their enrollments and it is not hard to visualize graduating classes of 6,000 - 7,000 students. This on a 10% basis would mean graduate school enrollments of 600 to 700 students.

It is also obvious that this number in the graduate school is not anywhere near large enough to supply the demand created for a person with this level of training by these large undergraduate enrollments. This coupled with the increases in staff demanded by the five year program will cause the demand to far exceed the supply. It should be apparent therefore, that the figure of 10% of our graduating classes entering graduate school is much too low. This figure must be raised to 20% as rapidly as facilities will permit. A graduate school enrollment of 1,000 to 1,200 students will be necessary to supply the demand by education and industry. This 20% is a minimum figure we should strive for and it is not unreasonable when one realizes that 42% of the graduates from chemistry courses went on into graduate school and received graduate degrees in chemistry. I believe we can say that if we cannot supply this

need from our restricted source of supply we will have to look elsewhere.

2. The student's desire to go on into graduate work is influenced by many factors, such as personal ambition, knowledge of the opportunities, desire for industrial work, encouragement and inspiration on part of undergraduate teachers, family environment, etc. Of all of these, encouragement and the inspiration created by his undergraduate teachers is most important. I should also like to emphasize that this must start in the student's first professional year. He should be immediately picked out for special emphasis and should be advised to elect the proper basic science courses to prepare him for graduate work. This must continue then through his undergraduate training and by his senior year should be directed into either thesis work or special problem courses to whet his appetite for research and develop his curiosity. This will require a maximum of effort and interest on the part of you teachers and I would like to emphasize again the very real need for these people in the graduate area. I would like to add also that it is my sincere belief that the encouraging and inspiring of students to seek all of the education their mental abilities permit is one of the most solemn duties of every teacher; whether they be in grade school, high school, college or professional schools.

I feel that since our greatest potential supply of graduate students is in our own professional schools it is the particular duty and obligation of you people in our schools of pharmacy which do not have or operate graduate schools, to see that the best of your students are encouraged to go on to graduate work. This would be one of the greatest services you could render your profession.

3. Financial Support. I realize that in discussing this problem of the graduate area many of you may be more familiar with it than I am. It is of course common knowledge and an accepted fact that nobody goes to graduate school in the professions or the natural sciences without some sort of financial support. It is common knowledge then also that in order to double our enrollment we must also double our financial support budget. An average stipend for a graduate student amounts to about \$1,500 and that multiplied

by 1,200 would be approximately \$1,800,000.

This figure of approximately \$2,000,000 certainly is an imposing amount but not an impossible amount. I imagine my first reaction to this figure and the number 1,200 graduate students was probably as violent as Dean Jordan's would have been had he been told that some day Purdue would have as many as 60 or more graduate students, or Dr. Kremers' if he would have been told that Wisconsin would grow to have that many graduate students; that our research budget would grow from literally a few thousand dollars a year to over \$100,000 a year--this figure alone almost five times what the whole school of pharmacy budget was during his time.

I mention these only because I feel there might be some of you who might be discouraged by the enormous task which lies ahead in meeting the problems of such a budget. I am not a man of the clergy and I am not going to preach, but I would like to ask you to have the courage and the faith to proceed with the task.

Pharmacy is one of the wealthiest professions in existence, it has the natural and financial resources to support a program of this magnitude. It asks only that you educators give it the wisdom it needs in the form of its human resources to achieve its greatest potential. Only then can it fulfill its obligation to society. Only then do we have the right to special privileges.

Discussion: The following matters were considered: (1) The opinion was expressed that graduate enrollment might increase after the inauguration of the extended program because the students would be better motivated. (2) Some Seminarians felt that graduate work should be restricted to persons with the baccalaureate degree in pharmacy because other students lacked allegiance to the profession; some felt this allegiance to and understanding of the profession might be achieved in the non-pharmacy graduates by requiring extra non-credit course work in pharmacy subjects. (3) The importance for the student of changing colleges for part or all of the graduate work was commented upon. (4) It was mentioned that the AACP committee on recruitment aids would be pleased to hear any suggestions regarding graduate study recruitment, even though present activities were concerned with the undergraduate program.

## THE NATURE OF GRADUATE STUDY IN PHARMACY

William J. Husa

U. of Florida

We may approach the topic "The Nature of Graduate Study in Pharmacy" by asking ourselves two questions:

1. How does graduate work in pharmacy differ from graduate study in other fields?
2. How does graduate work in pharmacy differ from undergraduate work in pharmacy?

## Comparison With Graduate Study in Other Fields

Obviously, graduate work in pharmacy has more in common with graduate instruction in other scientific fields requiring laboratory work than it does with so-called "library subjects" such as philosophy and languages. Furthermore, graduate work in pharmacy is more closely related to applied, professional areas such as medicine, dentistry, public health and engineering than to narrow fields of chemistry and physics in which the applicability of the studies to human needs is not of such immediate concern.

## Comparison With Undergraduate Work in Pharmacy

Looking at the second question, it is immediately apparent that graduate work in pharmacy can be carried out at a higher educational level than undergraduate work. This is true because the graduate program follows the undergraduate program and because entrance into graduate work is commonly limited to students who have shown more than average ability in the undergraduate curriculum, such as is represented by a B average in a four-letter grading system. Such a requirement is easily justified on the basis that it is to the advantage of society to have people of superior ability in key positions in research and teaching. Furthermore, the handling of complicated scientific apparatus in graduate work requires a higher degree of mental and physical ability than is true of the undergraduate program.

In graduate work it is common practice to prepare an individual program for each student, rather than to follow a required curriculum with a limited number of electives as in undergraduate work. This procedure opens up many opportunities to develop special skills, aptitudes and interests of individual students.

### Counseling Techniques

In arranging a program of study for an individual graduate student, we must remember what has long been known to educational philosophers, i.e. that material assigned for study loses most of its value unless it represents whole-hearted, worthy activity leading to a definite purpose. It is a mistake to merely fill in with a course here and a course there to make a predetermined number of credits.

When a prospective graduate student first interviews his counselor, a critical moment in his intellectual future has arrived. The counselor rightly feels that he is there to advise the student and he may think that in view of his superior knowledge and experience, he is able to "write out a ticket" for the student and save much useless discussion. However, when a counselor takes this attitude, there is grave danger that he is unwittingly instituting or perpetuating mental slavery by doing thinking which the student should do for himself. Plato defined a slave as a person who takes from another the purposes which control his conduct. When we dictate an educational program without giving the student a chance to think and decide some things for himself, we are making him an educational slave. Aristotle observed that the trouble with slavery is that the slaves themselves may come to like it. This thought is exemplified by the graduate student who is perfectly happy to go to his counselor to find out "what he has to take" and then takes it.

A better procedure is to do it the hard way by having several different meetings of student and counselor. In the first meeting the counselor seeks out the thoughts and purposes of the student and then discusses the requirements rather fully, pointing out the variations possible and the advantages and disadvantages of the various alternatives. He then asks the student to prepare a program and bring it in for discussion. When the student draws up a program, the counselor should ask the reason for each item and point out anything he thinks the student may have overlooked. A program arrived at by such a procedure should represent a close approximation to whole-hearted, worthy purposeful activity as envisaged in the philosophy of education. Furthermore, this procedure contributes to the development of mental freedom rather than to the perpetuation of mental slavery.

### Majors and Minors

The development of a program to fit the individual student is accomplished by judicious selection of major and

minors, as well as by selection of different individual courses in the various majors and minors. Usually, it is considered advisable to select minors from closely related fields that directly support the major. Lately there has been some talk in organizations of graduate deans regarding the supposed benefits of including a minor from some entirely different area of learning. The proponents of this idea have in mind the objective of broadening the interests of the graduate students. Professors in scientific fields have not taken kindly to the idea of going far afield for a minor. It has been said that an educated man is a broad man sharpened to a point. My view is that most of the broadening should be done early and most of the sharpening in the later stages of the period of formal training.

Graduate deans usually object if a pharmacy major tries to take all his minor work within the areas of pharmaceutical chemistry, pharmacology, and pharmacognosy. They say that at least one minor should be from a discipline outside of the pharmaceutical sciences. I feel that their point is well taken in the interest of avoiding overspecialization.

#### Cultural and Leadership Training

It has been said that we should train graduate students in pharmacy to be world citizens capable of helping solve the problems of humanity. Personally, I believe the place for cultural and citizenship training and a broad view of the world is in the pre-professional program and possibly to a limited extent in the undergraduate professional program, but not in the graduate program. However, graduate faculty members can promote the attainment of a broad culture by encouraging their graduate students to attend meetings of other groups, particularly when outstanding speakers appear in public lectures on the campus.

When we look into the question of what is cultural and what is vocational, we find there has been much loose thinking about these two terms. Instead of seeking the answer in the dictionary, I think it will be more profitable to look for it in our own minds. We all know that music and art are usually considered as typical cultural fields. Yet music and art are vocations for people who are engaged in them professionally as well as for teachers of these subjects. A graduate student may take courses in French in order to be able to read French scientific papers, but this vocational purpose does not bar him from enjoying the reading of French poetry and novels and absorbing much knowledge of French culture and civilization.

I once listened to two language scholars who were able to

converse in more than thirty languages. However, if such a person knew nothing of the sciences of plants, animals, people and the earth, he would certainly be one-sided and lacking in broad culture.

What a man thinks and says depends to some extent on what he has seen and done. Hence, it may not be out of place to say that my own early training consisted in completion of the old Ph.G. and Ph.C. curricula followed by a training in liberal arts leading to the Bachelor of Arts degree. Even after graduating from a college of liberal arts I have always thought that the educational and cultural value of the pharmacy curriculum has long been grossly underestimated. The botanical names and Latin terms give an awareness of ancient languages and cultures. The study of plants, animals and people, the insight into various realms of science, the glimpse into law and legal principles, and the study of the market place all tend to give a broad view of the world.

At long last educational philosophers are recognizing that there is much of the liberal in the vocational. Technology and engineering now extend their sway into the realm of the aesthetic. The goal of liberal education is now considered to be the development of persons who are equally competent in understanding people, ideas and machines.

#### Objectives of Graduate Study in Pharmacy

Another viewpoint for looking at the nature of graduate study in pharmacy is to consider the objectives of the program.

It happens that my first observations of graduate work occurred back in the days when the quiet contemplation of the scholar was now and then rudely interrupted by the clatter and roar of a two-cylinder automobile passing the ivy-covered walls on its way to the newly-opened nickelodeon, where a moving picture program lasting twenty minutes could be viewed for five cents. I hope and trust that my ideas about education have progressed with the times and are not mired back in the muddy roads of those by-gone days. However, I thought it might be well to check my ideas of educational objectives with those drawn up by one of my younger colleagues, Dr. Harold M. Beal, who has a degree in education in addition to his undergraduate and graduate training in pharmacy. Surprisingly enough, we found that our ideas coincided rather closely on the following list of objectives of graduate study in pharmacy.

1. To strengthen the background of the student by means of further courses in chemistry, mathematics or other basic sciences to gain the foundation necessary for

the creative requirements of pharmaceutical development and teaching.

2. By means of advanced pharmacy courses, to acquaint the student with some of the more advanced pharmaceutical knowledge, including manufacturing equipment and other tools available to him in pharmaceutical research.
3. By means of an original research problem, to instill in the candidate the desire for further investigations in the field, and to teach him the use of scientific literature and the art of scientific writing.

In the above list, we have not included the objective of developing the ability of the student to think clearly and have a broad vision as these objectives are common to all graduate work. Other general objectives could have been mentioned, such as development of the ability to cooperate with others in research projects. The graduate student must be conditioned for arduous, untiring concentration on a single problem in a limited area of knowledge or technology. In this respect the work of the research pharmacist differs greatly from that of the retail pharmacist, who takes up a multitude of problems every day, jumping from one to another every time the phone rings or a customer enters the store.

We believe that the objectives of graduate study in pharmacy such as the development of original thinking, the inspiration for creative effort, an improved knowledge of the major field, the strengthening of the background in the basic sciences, an increased ability in using scientific literature and the development of the art of scientific writing can be promoted within the usual framework of major, minor and dissertation. It has long been common practice to divide the work for the Ph.D. approximately equally between major, minor and dissertation. However, it has become quite common to require only course work for some master's degrees, thus reverting to a practice which was general seventy-five years ago. To a lesser degree, there has been some tendency to weaken the research requirements for doctor's degrees. I recall that some years ago a professor of education told me he was going to a certain large American university where he could get a doctor's degree without any research. Quite to the contrary, there are some who argue that work for the Ph.D. should be mostly research, with little or no time devoted to graduate courses in the major. I disagree with both extremes. A doctor's degree given for courses only is not worth the sheepskin it is printed on. The people who wish to do away with graduate courses in the major claim that a graduate student can pick up an advanced knowledge of his major field by himself in the library. This procedure would throw away all the

benefits of graduate classroom and laboratory work, such as the systematic approach, motivation, leadership and advice of the professor and would rob the student of the competition and stimulus of classmates.

In my presentation this morning I will not go into the important question of the part to be played in graduate work in pharmacy by lectures, seminars, laboratory work and non-thesis research problems, nor will I go into the techniques of evaluating the progress of graduate students as these topics will be discussed by the next speaker. Likewise, I will not elaborate on the nature and content of individual courses as these will doubtless be covered by the speakers on the afternoon program. However, I feel that a pharmacy major should definitely include a course in manufacturing procedures and equipment and a course dealing with the stabilization of pharmaceutical preparations. Another necessity is a course in instrumental analysis which may be offered by the department of chemistry or the department of pharmaceutical chemistry.

#### Prerequisites for Graduate Study in Pharmacy

In the construction of buildings it is axiomatic that a structure is no better than the foundation on which it stands. It seems self-evident that when we build a graduate program in pharmacy it should rest on a solid foundation represented by the degree of Bachelor of Science in Pharmacy. Looking back several decades in the history of pharmaceutical education, we find that some educational institutions were conferring master's degrees in pharmacy upon students who did not possess the basic pharmacy degree or its equivalent. At the 1934 meeting of the American Association of Colleges of Pharmacy in Washington, D. C., after a brilliant, stormy and spirited debate, a section was added to the A.A.C.P. by-laws specifying that "graduate work in pharmacy shall be interpreted as meaning work done after the completion of the requirements for the baccalaureate degree in a college of pharmacy." More recently, the A.A.C.P. by-laws have been silent regarding requirements for master's and doctor's degrees but common sense dictates that a graduate program must be built on a solid foundation.

Drugstore experience is usually not listed as a pre-requisite for graduate work in pharmacy. However, a year or more of good experience in retail pharmacy is helpful to any one contemplating a career in pharmaceutical research or teaching. A teacher who can give examples from experience is more likely to hold the interest of students. In pharmaceutical development a research man is likely to be more successful if he has become "product conscious" through experience in retail pharmacy.

## Training for Leadership

The training of leaders is considered a primary function of education. How do you train a person to be a leader? More than thirty years ago the great American statesman, William Jennings Bryan, delivered an address before the student body at the University of Florida. After the Great Commoner had expounded on the importance of leadership in a democracy, the time arrived for questions from the floor. A student rose and said, "Mr. Bryan, just how does one go about becoming a leader?" Without hesitation, the following reply was given: "The way to become a leader is to find out which way the people are going and then march in front of them." I know of no better prescription for leadership. A leader must peer into the future. He must look ahead and think ahead. Then if he has the courage and initiative to step out ahead of the procession, he is a leader.

In order to successfully direct the research of graduate students, a professor must be something of a psychologist. He must remember that many potentially good students become overawed by the vast accumulation of knowledge unfolded before their eyes. Very commonly they feel inadequate and discouraged and lose heart. At such times they need sympathy and encouragement. A professor must be honest and considerate in all he says and does. He must let the student know that he has confidence in his ability and prove it to the student by having the student successfully carry out small projects.

Recently, a newspaper editorial discussed the frustration of the average man these days in trying to have an intelligent knowledge of science in this atomic age. No matter where the average man turns or what he discusses, he is likely to run into specialists whose deep knowledge makes him feel ignorant. I think all of us have this feeling now and then even about the various ramifications of our own fields. In the previous century there were still a few men who were reputed to know all the chemical compounds which had been listed in the literature. Month by month the difficulty of maintaining their position increased. The story goes that finally one professor announced "Last month there were only two men in the world that knew all the chemical compounds, Victor Meyer and I. This month there is only one man that knows all the chemical compounds and he is Victor Meyer." In other words, the professor had wisely decided to throw up the sponge. Finally the strain became too great for Victor Meyer and he took his own life, leaving behind a scribbled note "ich kann nicht mehr. That is what you could call taking your work too seriously. Dr. George D. Beal once discussed this problem in the following

words: "But how does one keep abreast of the entire field of chemistry today? One doesn't. We have, instead, modified our course of training to teach the student where these things can be found, show him how to find them, and instruct him how to use them." This same reasoning applies to pharmacy.

### Selection of Research Problems

In selecting a research problem it is not wise to let the student work on any problem he may be interested in. For one thing, a problem may be worthy of solution but have a scope so great as to be beyond the accomplishment of the student in the allotted time. Working on a problem that is too large or to which there is no satisfactory approach leads to frustration and failure. Even if a problem selected by a student is proper as to scope, it may be in an area in which the professor is not sufficiently well qualified to give adequate supervision, or it may require equipment which is not available at the particular university. On the other hand, if a professor simply assigns a definite problem, the student is not being given an opportunity to use his head. A good procedure is to acquaint the student with a number of problems which the various professors are prepared to direct and have the student do some thinking and make a selection. In a large chemistry department having more than a hundred graduate students, the problem has been successfully handled by having a young Ph.D. devote practically full time to counseling graduate students regarding the selection of a research problem. Each professor keeps the counselor advised as to the number of places open and the problems he is willing to direct. The counselor then attempts to steer the graduate students into the problems they are interested in and qualified to attack. In a smaller department this function usually devolves on the department head.

It may be mentioned in passing that it is the height of folly to accept too many research students for the space that is available or to burden a professor with more students than he can supervise. The only safe procedure is to give a professor credit on his teaching load for each research student working under his direction and then to see that he does not have a teaching load in excess of commonly accepted standards. Directing one Ph.D. student is roughly equivalent to teaching a two-hour course.

In selecting a problem, it is wise or fortunate if it is in an area of greater future importance and thus furnishes leadership. But in choosing a problem, don't forget to look in the ash can. By that I mean that valuable results may

follow a new study of old drugs. I recall that several years ago I was looking at the structural formula of a chemical compound newly accepted by the U.S.P. At first I could not fathom where it came from or what gave any one the idea of using that structure. On further check, I found that this chemical was obtained from a crude drug which had been thrown out of the official books forty-five years ago. In that case it paid to look in the ash can.

One thing that makes research fascinating is that, like the roulette wheel, you can never be sure just what the result will be. Several years ago, a government laboratory in Peoria, Illinois, studied samples of mold from all over the world in search of a superior strain for the production of penicillin. Curiously enough, the best strain of those tested proved to be one obtained from a moldy cantaloupe picked up in the alley behind a supermarket right there in Peoria.

Long ago there seemed to be a clear demarcation between university research and industrial research. Industrial research was supposed to deal primarily with the problem of making two dollars grow where one grew before, whereas university research was supposed to be theoretical with little concern over possible useful applications. Today, however, things in this field are somewhat topsy-turvy. A great deal of theoretical research is now done by industrial concerns. On the other hand, some professors appear to be selecting problems with their eyes glued on the dollar sign, fervently hoping to find something patentable on which they may secure a royalty from their research foundation. Research foundations organized by universities for holding and administering patents covering useful discoveries made by professors and graduate students are, in themselves, a logical and useful development. However, if persons engage in university research primarily to get royalties, they have my sympathy as well as my contempt.

A primary consideration in the selection of a Ph.D. problem is to see that it familiarizes the student with some basic techniques that may be useful in his future career. For example, I had a Ph.D. candidate whose dissertation was concerned with the development of certain isotonic, buffered collyria. Later, when engaged in research for a drug manufacturer, he applied the same principles to a newly-discovered drug and after working diligently for two years to overcome various difficulties which arose, he formulated a product whose sales are measured in millions of dollars.

It is well to train the student to apply new data either to develop the theory of pharmacy or to make useful new products. As F. O. Taylor has said, "New data must be accumulated but

these new 'scientific bricks' are of no use unless used in some scientific construction, as bricks may be used in a building."

In passing we may note that the terms "pure research" and "industrial research" are not necessarily good terms to use. It might be better to use the terms "exploratory research" and "developmental research".

After many years of experience in research and graduate work, I am impressed with the individual differences one finds in graduate students. No two students are ever alike in their abilities and mental processes. To discover and develop the strong points and to help the student overcome his weak points is an interesting and rewarding experience.

#### THE NATURE OF GRADUATE STUDY IN PHARMACY

Elmer M. Plein

U. of Washington

How does a student obtain an advanced degree? Let us consider the answer to this question on the basis of the average requirements of the schools and colleges offering advanced degrees. First, the student must be admitted to the graduate school of the institution of his choice. He may accomplish this admission merely by presenting a "satisfactory" record of his undergraduate studies. Some colleges and schools however may require that the student take an entrance examination or qualifying examination. This examination alone may determine the extent of the student's graduate studies. If he does well on the examination, he will immediately be encouraged to extend his studies to the Ph.D. degree. If he makes an average grade on the examination, he will be asked to culminate his studies at the M. S. degree. If he does poorly on the examination he will not be admitted to the graduate school at all. It would seem that an entrance examination would have to be an extremely good one in order to predict the aptitude of the graduate student as closely as this procedure indicates. I would prefer to use the entrance examination as a placement test, which procedure is used in a number of schools. The results of the examination will provide some evidence of the quality of the candidate's previous training and will serve in aiding the counselor to advise him in the work he should follow.

For the master's degree the candidate will have to take 36 quarter credits (pharmacy and minor supporting courses)

and write a thesis for which he receives 9 quarter credits. For the doctor's degree 90 quarter credits of course work in pharmacy and minor or supporting courses are required and the candidate must write a thesis for which he earns 45 credits. The distribution of credits, major and minor, will vary with different schools and even with different candidates.

We sometimes hear the comment that there are not enough graduate courses in pharmacy, that the students are required to take a considerable number of courses in related fields in order to fulfill the requirements of the graduate school. I do not wish to debate the questions of the number of pharmacy courses we should have and the possible duplications which these courses might create with those in other departments. I will defend the procedure of enrolling the student in courses of related fields and I agree with those who feel that the graduate student should not only broaden his learning by taking these courses, but should come in contact with as many different professors in his own and in allied fields as possible. Learning to apply the fundamentals of these other physical sciences in the solution of problems within his own research is a valuable part of the student's graduate education.

While I am on this subject of specialty and related subjects, I should like to mention a statement sometimes heard, that we in pharmacy are too highly specialized and that our educational program is lacking in breadth. I think pharmacy is less deserving of this criticism than some other sciences. It is difficult to define pharmacy within narrow limits because pharmacy includes the principles of several related fields.

The graduate student takes courses just as he did when he was an undergraduate. He may take a course along with undergraduate students. This does not prove to be an undesirable situation because the requirements and grading of the graduate student may be different than those of the undergraduate. Where the requirements and grading for each type of student are the same, the graduate student may find that he has competition for a good grade in the course because his undergraduate fellow students may be majoring in this particular field of study, whereas the graduate student may have entered this course with less background upon which to base his present study of the course material.

Graduate courses should be taught in such a manner that the student will be encouraged to think for himself. As Walter Russell<sup>1</sup> has put it, the graduate student should be considered as an individual working independently to equip

himself thoroughly for his career. Undergraduate courses are often presented in routine, hand-feeding procedures so that the student needs only to accept the professor's lecture, read his text book assignments and parrot back the information at examination time.

Graduate courses require good outlines just as do the undergraduate courses. The student and the professor must mutually understand the objectives of the course and the material content of the course. The manner of presentation of the course material should perhaps vary more than in the presentation of undergraduate material. The variety of presentation methods employed will depend upon the subject matter and the students in the course. I might illustrate the point at hand by mentioning a course, Solvents and Solvent Extraction, which I taught this last year. As long as I presented the material in lecture fashion the students studied only that which I talked about and they learned this material quite well. Even the theories of solvent activity were studied only so far as they were discussed in the classroom. However, when seminar topics were assigned, each student made an earnest effort to present his topics in complete fashion including a discussion of the theories of solvent action and the application of these theories to practical methods.

The professor should be available for consultations and he should be willing to direct the efforts of the student in the course, but the student should be taught to think for himself and to proceed in an independent manner to seek out the information as set down in the outline of the course.

Laboratory work is a valuable teaching aid and should be closely correlated with the lecture portion of the course. Laboratory work at the graduate level (as well as at the undergraduate level) should not be of the cook-book variety where the student performs certain experiments without knowing the fundamental principles of the procedures and the reasons for carrying them out in a certain manner. It is in the laboratory where the student learns by doing experiments, but the laboratory work must be planned in order to produce the desired results.

Laboratory work at the graduate level, I believe, requires a laboratory manual or procedure instructions for a few of the experiments, but the student should be encouraged to use the library to find the answer to many of his problems. In these instances reports are necessary, but the student learns as he prepares the reports.

In the course work system there must usually be examinations as a means of testing achievement in each course. These examinations, even if well designed are still necessarily pointed and test the individual's achievement in only that course, one segment of his educational program. From most students' points of view they would rather have examinations in each course than to have a comprehensive examination after the completion of all graduate courses. They can make better marks by concentrating on each individual examination than by attempting to cover the whole field with a single examination. Some students admit that they spend more time studying the course material when they realize an examination is coming than when they know good attendance and a moderate amount of class recitation will put them through the course. Such a student as the latter, however, either is not a good scholar or his counselor has not convinced him of the objectives and the purposes of the graduate school.

The graduate student has to meet a number of responsibilities before he is prepared for the general and final examinations. Let us, therefore, direct our attention to some of the other means by which he meets these responsibilities and obtains his graduate education.

The seminar method of presenting material in class had been mentioned previously. I would like to discuss the subject of "Seminars" along with "Report Writing" and "Literature Searches". At the University of Washington we hold bi-weekly seminars and the graduate students take their turns in presenting their research or reports on some subject selected from current literature.

About all the student gains from the presentation of his research is practice in talking to an assembly of the faculty and the other graduate students. He already knows about his own research and he has had to complete the literature research for his problem. In other words he learns nothing additional in presenting his own research to this assembly composed of individuals from all phases of endeavor in the College of Pharmacy. There is a place for such presentations which I will discuss in a moment.

The type of subject suitable for presentation to this diversified group preferably should be one unrelated to the student's own research. The student finds it is necessary in preparing his discussion to refer to current literature which probably will carry him back into older journals for additional references. The advantages of the system are that the student has opportunities to collect material from the literature and

organize it into an instructive paper and report. He develops an appreciation of the usefulness of the library and gains practice in presenting the material and answering questions following the presentations. His fellow students are encouraged to ask questions about the report.

Perhaps the most important possibility in teaching by the seminar method is to teach the student to evaluate the paper or papers on which he reports. It is one thing for him to present a long dissertation simply as a report and quite another for him to criticize the paper after he has presented that report. As Walter Russell says, it is only after a student has learned to hold up a paper to critical view that he is beginning really to think in his field of work.<sup>1</sup>

It has been pointed out that the student is required to write a paper representing the report which he gives in the seminar. Some directors of research require their students to prepare periodic reports on the progress they make in their research. The data are given in some detail and an evaluation of the data is also required. Walter Hartung<sup>2</sup> and Walter Russell<sup>1</sup> have emphasized the value which the student derives from instruction in keeping notes on research and the writing of such notes into satisfactory reports. The latter author has explained how the procedure of editing these notes and reports helps the candidate in his position should he later be employed in a research laboratory.

I indicated a while ago there was still another type of seminar before which the student might report on his own research and on published papers in closely allied subjects. This seminar is held within his own department (Pharmacy) although visitors from other departments are always welcome. The group meets periodically and each graduate student takes his turn in presenting the progress of his own research. The professor who is directing the research being reported on is always present. The advantages of this type of seminar are many. The student has an opportunity to prepare and to present the report on his research. He gains practice in speaking to the group even though it may be a small group. He has an opportunity to present and defend the theories involved in his research. It gives the director an opportunity to follow the research in a more critical manner because he observes the method of presentation and hears the questions and comments directed toward the research as the other members of the seminar evaluate the work critically.

Occasionally faculty members in the department and in allied departments present their research. Visiting faculty

and guest lecturers from other schools and visiting personnel from industrial concerns occasionally are conveniently present and can give a talk of value to the assembled graduate students. Graduate students and instructors who conduct departmental seminars are enthusiastically in favor of the system.

Reports by faculty members from other departments and by specialists in various fields can be given in another manner. Martin and Sprowls<sup>3</sup> have presented a paper on a course in Graduate Orientation and Research Indoctrination. This course, which might precede the departmental seminars, is designed to introduce the graduate student into the educational system at the graduate level and to provide him with an understanding of the stages of a research problem. The course is conducted one hour each week for two semesters.

I presume a number of schools have a course in non-thesis research. This course again includes a literature search and report writing, in fact it may be purely a library problem. It may also include laboratory work. The project may be one which extends over several quarters or more likely it may be one which can be completed in one term. It might involve some U.S.P. or N.F. Committee Work, or the construction of some special piece of apparatus. The instructor might assign a project which involves one or more phases of his own research work. The non-thesis research course gives the graduate student an opportunity to learn some general principles involved in research and to learn about specific projects. The instructor directing a course in non-thesis research has a serious responsibility because such courses usually require close supervision. It is not enough to assign a library or laboratory problem and leave the student on his own. One may find him a few weeks later floundering in the midst of books or laboratory apparatus. The non-thesis research course work is generally the idea of the professor and in order for the work to be brought to the desired end, frequent conferences with the student are necessary.

I would like to discuss for a time the training of graduate students as prospective college teachers. I have had students tell me they thought this phase of their graduate training was the most important of all. These students, of course, intended to go into teaching.

Teaching assistantships or teaching fellowships are a convenient means of training the prospective teachers. These assistants or fellows are usually employed to assist in the laboratory which happens to be a convenient place to start the teaching education of the graduate student. The professor

can contribute much to the education of his assistant by working closely with him in the laboratory. I need not discuss how the professor can give the assistant certain teaching responsibilities in the laboratory and in the quiz sections, and finally the responsibility of talking to the whole class on some phase of the course work. These responsibilities give the graduate student the necessary experience in his contacts with the students, but the experience will be meaningless without the constant guiding influence of the instructor in charge of the course.

Many authors have written that to be an effective teacher that teacher must also be a good researcher. In fact in some institutions research is the basis upon which advancements in salary and rank of the teacher depend. Melvin Green<sup>4</sup> has written that instead of a dichotomy (research and teaching) there is really a trichotomy: research, scholarship, and communication. "Research," he says, "is the effort to discover new facts or to recover lost or forgotten facts, while scholarship is the organization, criticism, and interpretation of facts and concepts." Professor Cowley of Stanford University, Melvin Green quoted in part, by writing that research, scholarship and teaching depend upon each other: "that without research, scholarship degenerates...without scholarship, research decays...and without both research and scholarship, teaching becomes bromidic prattling."

I will not discuss the language requirements for the master's and the doctoral candidate, but I will raise a question or two. In many institutions the candidates all take the same examinations, usually written, regardless of their major field of study. Is the "story-book" type of examination sufficient or should we require something in addition to it and something more specific and more adaptable to our research literature? Then there are those educators who advocate that we should have no language requirements--that professional translators are the answer to whatever translation requirement the student may have.

The selection of the research problem is usually left to the research supervisor and the graduate student. There are those who advocate the student starting on his research early in his graduate program even though he will have a heavy course load--then increasing the research time as the number of course credits per term decreases.

Inasmuch as the research amounts to one-fifth the total credits of the master's candidate and to one-third of the total credits of the doctoral candidate, considerable emphasis

should be placed on the research problem. The research problem affords many possibilities of teaching for the instructor. Literature searches, report writing, seminars, laboratory work, thesis writing, critical evaluation, and others are all directly or indirectly related to the candidate's research and his graduate education.

I do not want to become involved in a discussion of what is pharmacy research, but I do believe we in pharmacy are very fortunate in having so many research problems from which to choose. Then too, the problems can be attacked from different viewpoints depending upon which of the allied sciences the candidate has chosen; and consequently, the tools with which to work in solving his problem.

When the master's candidate has completed his course work and his research and his advisor feels he is qualified, he takes a general examination over his major and minor courses of study and defends his thesis. The examination may be oral or a combination of oral and written.

When the advisor of the doctoral candidate feels he is qualified, he takes a General Examination or Preliminary Examination. This examination may be written, oral, or both and covers both his major and minor fields of study. It is the important examination, because it covers all the small segments previously mentioned and it determines, by and large, if the candidate will be successful in earning the Ph.D. degree.

The subject of faculty participation in examining the candidates might well be left for discussion in another section, but it can be included here. The faculty man who accepts the invitation to examine a candidate for an advanced degree has accepted a serious responsibility. He should come to the oral examination as well prepared to ask questions as he expects his students to be when they walk into the classroom. The questions, I believe, should be well thought out and if necessary should be written out so the professor can follow his questions to the completion of his part of the examination. The questions asked by other examiners and the answers which the candidate gives will very likely alter the questions and the order in which the professor presents them. Nevertheless, he is prepared. The examiner should remain in the meeting during the entire examination. If he spends only 10 or 15 minutes with the examining committee it may indicate he is not interested, but has accepted the invitation merely as a duty.

Consider the student's point of view also. For months

he has prepared for this examination, a big event in his life, and he would rather have a good examination and "just pass" than to have only a few narrowly limited questions put to him and "do well." The latter method makes him feel it was useless to put forth all the effort on the intense study.

The final examination for the doctoral candidate is a presentation and defense of his thesis. In most schools, attendance at the examination is restricted to the examining committee. However, I favor the method used in some schools where the presentation of the thesis is given as a seminar and is open to anyone who wishes to attend, students included. This procedure gives the candidate an audience to talk to and this method makes for a better presentation than if he were talking only to his committee which might be made up of as few as four or five members. When the "seminar" presentation of the thesis has been completed, everyone except the members of the examining committee and visiting faculty members is excused and the candidate defends his thesis against the questions of the committee.

I would like to discuss for a few minutes the Cumulative Examinations system now in use in the Department of Chemistry and Chemical Engineering of our university. The system is also used at Harvard and UCLA. In this system the minimum first year program consists of 27 credits of graduate courses in which the candidate receives grades. After the first year, examinations in individual courses and the general or preliminary examination for the doctoral degree are replaced by cumulative examinations.

The cumulative examinations are general examinations in the student's field of specialization and are designed to stimulate independent study and thought. They attempt to evaluate the breadth of knowledge gained from courses, seminars, and the literature and the student's ability to apply this knowledge to problems of a diverse nature. The areas covered by the examination are never announced. For example, if a student is majoring in physical chemistry he may be examined on thermodynamics, heterogeneous equilibrium, or electrochemistry. The questions might be taken directly from course work or they might be taken from current literature. The student takes the cumulatives regularly, twice each quarter, and the cumulative requirement is satisfied when the student has passed six examinations, usually out of the first eighteen taken.

In order to satisfy the 90 hours of course work required by the Graduate School for the Ph.D. degree, courses taken after the first year are graded "S" and the student is not

required to take formal examinations in courses in the chemistry department, except as may be specified by his research supervisor or the department. Master's degree candidates take the usual general examination at the completion of their work.

I know of no College of Pharmacy using this system, but I do think the procedure worthy of mentioning and discussing.

This discussion has been a resume of some of the methods used in graduate instruction in pharmacy. It has included a consideration of some of the methods of measuring the achievement of the student as well as teaching him to measure up to the standards we set. The usual course work, laboratory work, and testing with entrance examinations, course examinations, language examinations, and cumulative examinations are all geared to the education of a number of students at one time. To a lesser extent we could also include seminars of the general type for all students in the college. In the scramble of mass education the immense value of professor-individual student instruction must not be minimized. Seminars of purely departmental personnel give a considerably greater professor-student contact than the other methods and measurements just mentioned. Pharmacy is such a widely diversified field of endeavor that each student needs individual help with his class and research problems. Working along closely with the student is the only effective manner of accomplishing our objectives in graduate pharmaceutical education. Consultations, reports, non-thesis research, research problems, and teaching assistantships are individualized procedures for education. Each graduate student presents an individual problem in the process of his education. In these latter methods he receives the much needed close contact. The general examination and the final examination are testing procedures on an individualized basis.

An environment of active faculty research stimulates the graduate student in his studies and research. The fact that research is going on all around him, and the unsolved problems posed by the research engender both curiosity and enthusiasm on the part of the student. Faculty research would be encouraged by following the plan used in medical schools. This plan periodically relieves the graduate faculty man from his class work for a quarter so that he can devote his time to research.

In considering research in pharmacy we should not lose sight of research in the field of pharmaceutical education. Especially in graduate education we should strive to train our research specialists and teachers for the future. It is

through the use of varied and new methods of teaching that we can accomplish this aim.

#### References

- 1 Russell, Walter C., Am. J. Pharm. Ed., 14:533 (October, 1950)
- 2 Hartung, Walter H., Ibid., 13:162 (January, 1949)
- 3 Martin, A. N. and Sprowls, J. B., Ibid., 16:247 (April, 1952)
- 4 Green, Melvin W., Ibid., 17:541 (October, 1953)

Discussion: There was no discussion recorded pertinent to these papers.

#### GRADUATE STUDY IN HOSPITAL PHARMACY

L. C. Zopf

S. U. of Iowa

It is unnecessary to determine where hospital pharmacy changed from a position of minority to a specialization of paramount importance. Rather, it is of concern to this group and to the profession of pharmacy that we as teachers make certain of the continued and expanded development of a firm program. I was privileged to present a paper on an outline for hospital dispensing at the first Teachers' Seminar conducted by the American Association of Colleges of Pharmacy held at the University of Wisconsin in 1949. The report was favorably accepted, but my most vivid recollection was the concern regarding the definition for this area of specialization. The Curriculum Committee of our Association too was having difficulty in defining this division of pharmacy, but ultimately developed what the majority agreed might be defined as the objectives which the student should achieve through training in hospital pharmacy. With slight modifications these objectives were:

1. Gain a sense of personal responsibility. The responsibilities are limited to his professional activities.
2. Gain a knowledge of the several types of hospitals and their pharmaceutical requirements. General types both voluntary and charity; special clinical types such as children's, women's, eye and ear, cancer, contagious diseases, tuberculosis, etc.
3. Gain a knowledge of the organizational plans of hospitals; relationships of management and professional staff.
4. Gain a knowledge of institutional purchasing and stock control.
5. Gain experience in manufacturing and quality control

of pharmaceuticals on a hospital scale.

6. Gain familiarity with the functions of hospital laboratories and clinics.
7. Gain increased assurance in pharmacist-physician relationship.
8. Gain increased assurance in pharmacist-patient relationship.
9. Gain increased familiarity with the specialized literature of medicine and pharmacy.
10. Gain familiarity with the terminology and purposes of surgical instruments and supplies.
11. Gain increased appreciation of the need for specialized medication and cooperative research in this field.

It becomes evident immediately that only a relatively small number of these objectives can be given adequate consideration at the undergraduate level. The most that can be anticipated is an orientation of the student in the specialization, and to determine from this orientation whether he has the motivation, the personality--yes, the finesse, which are requisites for his success.

In 1954 President Rief of the American Association of Colleges of Pharmacy appointed a special committee to meet with representatives of the American Society of Hospital Pharmacists and to report to our Association on hospital pharmacy education. This meeting was held, and I would like at this point to introduce one paragraph from their report:

"This joint committee agreed that a person who has graduated from an accredited college of pharmacy with sound fundamental training in the basic sciences and pharmaceutical technology was sufficiently prepared for beginning a career in hospital pharmacy. It was agreed that in order for the student to determine if he wishes to become a hospital pharmacist, the college of pharmacy should offer him some information about the nature of the work just as it should about other phases of pharmacy. It is suggested that this orientation should be offered in the senior year of the undergraduate program."

Other committees of similar representation have convened during preceding years and have developed a clearer understanding of the requisites for a major in hospital pharmacy. At no time have these committees assumed every college to be eligible to offer work in this division of pharmacy. To compliment the academic training the college should have an association with one or more hospitals where a practical rotational pharmacy internship program can be developed and where supervision of the program is possible by a college staff pharmacist, or where the chief pharmacist of the hospital is given

representation on the college staff.

Since I have been unable to attend the previous sessions of this Seminar, I hope you will forgive me if I introduce points of discussion which may have been thoroughly reviewed on previous occasions. I doubt, however, that a reiteration of some of the points will be out of order.

We in pharmacy are proud of our pioneer colleagues who established and maintained pharmaceutical services for hospitals in the earlier years. Our predecessors were exposed to conditions which must have resulted in very disheartening experiences. It is understandable they could well have been chagrined and embarrassed, not because of personal inadequacies, but because their educational background and professional standing were at that time subordinate to their allied professional colleagues. "Drug Room" was accepted terminology for the pharmacy, physicians as well as administrators being unaware of the potential professional service which far overshadowed the dispensing value of the pharmacy unit. The compensation of the hospital pharmacist up to a very few years ago was such that it did not attract a sufficient number of superior people. With deepest gratitude to these pioneers, we also recognize that elevation of educational standards for pharmacy has done much to increase our professional prestige.

The General Report of the Pharmaceutical Survey was most complimentary in its statement regarding hospital pharmacy:

"The pharmacist engaged in hospital practice holds a most, if not the most, strategic and important position in the entire field of professional practice. By virtue of the environment in which he practices, demands are made upon his professional and personal abilities which indeed represent a challenge. The proper discharge of his duties, as well as his success in what is a vital public relations responsibility, affect not only his hospital, its patients and staff, but reflect sharply on the profession outside the hospital's walls."

It is reasonable to believe that students who wish to pursue graduate instruction in hospital pharmacy should meet the standards and qualifications of other graduate candidates. Since they are venturing into a specialized area, however, it is desirable that additional consideration be given to the individual's personality, amenability and maturity of judgment. Not all pharmaceutically trained persons could be successful in the practice of hospital pharmacy. Hospital pharmacy has certain objectional features; for example, it is quite confining, in some ways it appears subordinating, and in certain hospitals

the pharmacist is isolated from a person-to-person association, much of the work being carried on by telephone, messenger or professional contact personnel. It requires a strong personality, a competent professional individual, to direct proper attention to the professional service offered by the pharmacist. An affable person is, of course, preferable, but affability must be associated with professional competency.

In an effort to discuss the program for graduate training in hospital pharmacy, I have chosen to divide my discussion into the non-professional and professional subjects.

#### NON-PROFESSIONAL:

It may be assumed the undergraduate has received a fundamental general education along with his professional training; that he has acquired the ability of communications, to express himself on varied activities, as conversing casually with friends or speaking formally with business associates; writing personal letters or composing detailed reports; listening intelligently and responding appropriately. The ability to communicate is universally recognized in statements of goals of general education. At no time during life will the need to communicate cease. Continued self-training or specialized training by others in the improvement of communication skills is vital for all men of society--even more so for the pharmacist. A hospital pharmacist must understand how to collect materials and information, to arrange the facts in an orderly way, and to express technical materials in an intelligent and non-technical fashion. Unfortunately the pharmacist is required to make many reports, and the ability to express himself clearly and concisely is a matter of understanding methods of communication.

To be of the greatest importance to the hospital a pharmacist must understand the social and economic problems which confront the hospital, and must contribute to improved public relations for the institution. The social problems of the entire institution are best handled by administrative experts, but the economics of the operation of the institution are a very pressing demand upon the pharmacist. If possible to arrange, the candidate should have expanded training in marketing functions, administration, business law and personnel management. Courses in sociology and psychology are desirable; however, until an adjustment is made in the undergraduate program, it is doubtful that all of these general educational subjects can be included, even in a program for a graduate with a Master's degree.

A list of colleges offering programs in hospital pharmacy may be found in the Education and Internship issue of the Bulletin of the American Society of Hospital Pharmacists, May-June 1955. If the programs listed in this edition of the Bulletin were outlined, we would find that they vary in scope, and intensity and that there is controversy and disagreement on subject matter. The purpose of this paper is to review specific subject matter for discussion and is not intended as a dictum for the design of every graduate curriculum. Designing an inflexible matrix for the graduate training of any student is a mistake. The individual's qualifications should be carefully evaluated; therefore, the student must be considered on the basis of his aptitudes and his undergraduate training. Being fully apprised of the versatility in our undergraduate programs, let us proceed to discuss the professional areas for advanced work.

#### PROFESSIONAL SUBJECTS:

Hospital Pharmacy. The advanced professional courses in pharmacy will have a latitude determined by physical facilities of the college and the qualifications of the professional staff. Administrative requisites for the hospital pharmacist should receive concentrated attention at this point, and the work should embrace such subjects as the history of hospital pharmacy, orientation in hospital operational procedures, interdepartmental relations, departmental records, purchasing and inventory, compilation of formularies, and therapeutic agent classification. In summary, it would include the application of business principles to problems peculiar to dispensing in a hospital.

Manufacturing Pharmacy. Discussion during the week indicates that in the majority of our undergraduate programs manufacturing pharmacy is offered as an optional course. As further explained, in those colleges where manufacturing pharmacy is offered, it is almost certain that the student has not acquired the skills necessary to make him proficient in the operation of general manufacturing procedures. The techniques can be introduced, but the skills not sufficiently developed. In hospitals of one hundred beds or more, it is reasonably certain that the economics of a sound manufacturing program cannot be disputed. Following indoctrination in fundamental techniques our candidate can only become proficient through guidance and practice in these technical operations. Associated with acquisition of the skill, the student must also have a theoretical understanding of the principles involved.

Pharmacy. Some colleges prefer to describe this course

as physical pharmacy, others as advanced pharmacy, still others as special dispensing procedures. In this course a student should give thorough consideration to the theoretical principles of colloidal and surface chemistry with special attention to the effect in emulsion techniques. He must receive expanded training in the principles and methods of preparation of sterile ophthalmic and parenteral preparations. Preferably, the course to be offered will combine lecture and seminar with advanced laboratory techniques. Special problems should be assigned the student in this course to stimulate original thinking and permit him to experience the compromise which exists between theoretical concepts and practical applications.

Expanded pharmaceutical manufacturing in the hospital pharmacy imposes need for pharmaceutical quality control. With the introduction of many new methods of instrumental analysis, it is reasonable to assume the student should have fundamental training in pharmaceutical quality control, thus enabling him to adapt accurate and modernized methods of assay consistent with the manufacturing program.

Additional topics which should be listed as electives to the already crowded program are anatomy, pathology, toxicological analysis, immunology and serology, clinical biochemistry and isotope tracer techniques.

Pharmacology. Provided the student presents a strong undergraduate pharmacology background, he should be encouraged to enter pharmacology courses of specialized design, such advanced pharmacological topics as chemobiodynamics, pharmacological projects, or special techniques in pharmacology. It is difficult to assume overemphasis in the area of pharmacological and physiological training for the hospital pharmacist. Through his medium comes the strongest bond of interprofessional understanding with his medical colleagues.

Pharmaceutical Research. Pharmaceutical research stimulates the initiative, fortifies the student's confidence, and should establish the habit of perusal of scientific literature. Once having undertaken a research problem, the pharmacist is more sympathetic and understanding of the research investigations and clinical programs of the hospital. It elevates the hospital pharmacist beyond the professional and managerial functions of his position.

The internship program assures our student will be available for two years and that approximately 50% of this time will be devoted to his practical training in a properly supervised

pharmacy of an accredited hospital. This portion of his training program is very important and should conform with the general recommendations made by our committees on hospital pharmacy. I can not be overly enthusiastic toward the recommendations for laborious detailed reporting of some of the internship training programs, but can visualize the merit of the system if these reports form the nucleus of discussion at staff-intern seminars.

The internship program should assure the student of sufficient training in all divisions of hospital pharmacy operation so that he becomes confident of his ability to perform his administrative duties equally as well as his professional responsibilities. The internship program should be on a rotational basis, permitting the candidate to gain experience in procurement and supply, manufacturing, bulk and ward dispensing, out-patient dispensing, and in-patient compounding. The intern must have opportunity for interprofessional contacts, for only experience affords assurance of his qualifications, both professionally and administratively.

Discussion: The principal points covered were: (1) In answer to a question regarding the length of the internship program, the speaker indicated that his college employed an integrated two-year program but that some have recommended a separated plan with all the academic work in the first year. (2) A Seminarian warned against the increasing tendency of the schools to assume the responsibility for orientation to the special areas of pharmacy. He believed this could best take place in the field if the academic program were good enough.

#### A GRADUATE PROGRAM IN MANUFACTURING PHARMACY

Albert M. Mattocks

U. of Michigan

Before discussing the training of graduate students for industrial research in pharmacy--that is what I interpret my title to mean--I feel obliged to make some remarks about the status of pharmaceutical research in industry. Most of the pharmaceutical companies have invested large amounts in research in the past ten to fifteen years. Most of this money has gone into the building up of organic chemistry and pharmacology departments with the hope of discovering new compounds that can be patented and which will be useful therapeutically, thus affording the company an exclusive market and enabling them to charge a high enough markup to pay for the research costs and squeeze out a nice profit at the same time. Anyone

ESS

who has seen this type of setup soon realizes that hundreds of new compounds are synthesized and tested pharmacologically before one is found that is worthy of clinical trial. Dozens go through expensive clinical trial before one is found to be marketable. Even then, the marketable one frequently has such a limited demand as to be quite a disappointment, or competition may soon beat it out, or new untoward side-effects are found. Often the new drug requires such a large investment in promotion that the profits are small. When one sees how few really good new synthetic drugs are produced, perhaps two a year, then he can see that the chances are that an organic-pharmacology team might be expected to produce a valuable drug only about every five years. Meanwhile, the pharmaceutical industry has depended strongly on new dosage forms and new combinations of older drugs to carry the costs of production and much of the research. Certainly, many a company has depended for its very existence on the pharmaceutical research developments. I believe that the pharmaceutical industry is beginning to realize this. They are beginning to see that a new dosage form such as the spansule or the film sealed tablet may be worth as much as a new synthetic organic drug. Also, they are realizing that the degree to which they can capitalize on discovery of a new drug may depend strongly on their ability to develop suitable dosage forms and combinations. In other words, I believe that pharmaceutical research is about to come into its own. It is being recognized as potentially one of the most productive types of research.

Can the research pharmacist take advantage of this improved opportunity? Is he prepared to step from an essentially service position where he has conducted the mix-two-drugs-and-make-a-tablet type of research to a new and deeper type searching in a scientific manner to improve drug absorption, regulate its rate of action, increase its stability and retard its excretion? Can he plan, organize and conduct long-term research which will be meaningful and will be fruitful in developing products that have something basically new and advantageous in the treatment of disease?

Most of you realize that the majority of research pharmacists today are conducting their research by trial and error methods. There is very little in the pharmaceutical literature in the way of general principles which can be applied to a wide number of problems--the literature itself is largely reports of trial and error experiments. These pharmacists are not dumb-bunnies; on the contrary, they are as a whole well trained in the fundamentals of chemistry, physics and the pharmaceutical sciences. They realize as well as anyone else the non-scientific manner in which they must conduct their

research. They would like to do something about it, but they are limited as to how much they can sell management, they are so busy with everyday problems that they do not have time to make sweeping changes, and they are limited to obtaining new men on their staff who often are no better prepared to revise research methods than they.

To be more direct, I believe that there is a tremendous opportunity today to advance industrial pharmacy research to the stature of a full-scale basic research program equally as important to the research division and as valuable to the company as organic chemistry and pharmacology. This can be done only by improving the depth of our thinking, and the organization and methods of pharmaceutical research. I believe that it is up to the colleges to make these advances.

We must search out methods for more effective investigation in pharmacy, develop them further, and teach them to our students. Certainly, we must continue to have our students well grounded in chemistry, physics and the other basic sciences, but in addition we must teach them to apply these principles to pharmaceutical problems. We also must teach planning, organizing and interpreting research problems.

It is not my purpose today to tell you how you should direct a graduate program in manufacturing pharmacy or even to set up an ideal program. I have the firm belief that the maximum value can be achieved only by shaping the program around the special experiences, talents and interests of the teachers in your individual school. The best I can hope to accomplish, then, is to tell you our philosophy and show how we have attempted to reach our goals. Perhaps in this way I may indicate some potentials you previously have overlooked.

Probably the best way to arrive at a selection of courses for our research pharmacist is to see what his duties will be when he goes out into industry. Ideally we should see that he is prepared for each of these functions.

The pharmacist in industry first of all must perform laboratory tests with chemicals. His work is directly concerned with physical and chemical properties of chemical compounds. Thus, he must have a thorough working knowledge of inorganic, analytical, organic, and physical chemistry.

The pharmacist utilizes bacteriology to a large extent in testing and assaying products as well as studying preservation and sanitation procedures. He is frequently the supervisor of a microbiological assay and test group.

He is concerned not only with developing a new formula but also with putting it into practice. He must supervise or be responsible for the successful manufacture of new products in the plant. Also, he is general trouble-shooter for older products. This type of work demands personal characteristics not demanded by any other research field. As for training, it requires a working knowledge of common manufacturing equipment and methods, of control procedures and materials handling--thus, he must have good training in manufacturing pharmacy.

The industrial pharmacist should be able to handle data of the type resulting from industrial operations so as to interpret it correctly and intelligently. This calls for a knowledge of statistical analysis and quality control.

In addition to his laboratory functions the pharmacist must serve on committees to suggest new products, to determine the value of research already completed or in progress. He must fit his program into the larger research project. For these functions he needs a knowledge of physiology, pharmacology and biochemistry.

It may be of interest at this point to see how we, at the University of Michigan, have selected courses to meet these requirements.

#### U OF M BASIC CURRICULUM--PRODUCT DEVELOPMENT

Chemistry		
Inorganic	----	
Analytical	Advanced Pharmaceutical Analysis	3-6
Organic	Qualitative Organic Analysis	2
	Advanced Organic Chemistry	3
	Organic Mechanisms or Heterocycles	3
Physical	Principles of Physical Chemistry	6
	Physical Chemistry Laboratory	4
	Colloid Chemistry	2
	Kinetics	2
	Phase Rule (?)	2
Bacteriology	----	
Pharmacology	Medical Physiology	4
	Medical Pharmacology	4
	Advanced Pharmacology Courses	2 ea.
Biochemistry	Medical Biochemistry	4
	Advanced Biochemistry Courses	2 ea.
Manufacturing Pharmacy		6
Mathematics through Calculus (undergraduate credit only)	Differential Equations Statistical Analysis	2 6

A graduate having received this training would be able to step into an industrial job and maintain his position. He has been well trained in the basic sciences. Yet, we would expect this fellow might contribute little to advancing the field of pharmaceutical research--it is what he learns beyond this point which will be the key to his success. What he learns now must be highly specialized and constitutes the training that we give with the intention of advancing the student beyond today's methods of pharmaceutical research.

Our first goal in these advanced courses is to teach the student how to apply the principles of physics and chemistry to pharmaceutical materials. He must see how measurements of pharmaceuticals are made and what they mean in terms of a process, a product, stability of a compound or compatibility of a mixture. Although the student has learned general principles in his studies it is quite common to find that even his basic theory in many topics must be advanced before he can apply it to specific problems. Then he must actually make applications of his knowledge to pharmaceutical materials to see how it can be useful to him.

To accomplish this we have set up graduate courses designed to follow the basic curriculum you have just seen. These are difficult courses to develop and will certainly require several years before one can be satisfied with them. The first of them is called Physical Pharmacy, and it is the course intended to develop theory not previously covered in physical chemistry or other courses but which is important to pharmacy. Probably in the future this will have to be split up and enlarged so as to make it two or three courses, for the amount of material that might be included is enormous. At present our selection of subject material consists of Experimental Design, Rheology--including powder technology, suspensions and emulsions, Solubilization and Complex Formation. The theory is presented with possible applications always in mind and with problems as practical as possible. The laboratory consists chiefly of methods of measurement.

Some special mention might be made of the teaching of experimental design. This is a most fascinating subject to teach and a highly important one in my opinion. Our experience has been that the basic courses in statistical analysis give the student a good understanding of the basis for statistical methods and a working knowledge of simpler techniques but do not prepare him to set up an experiment involving complex reactions or to analyze or interpret results from such experiments. Courses in advanced statistical techniques available from the mathematics department are quite time-consuming and

still are not suitable for our purposes. The use of statistical methods in chemistry other than in analysis is quite new, and the number of examples in the pharmaceutical literature can be counted on the fingers of one hand. Thus it is up to us to develop methods as well as teach our students the use of statistical designs in our own field. We concentrate on the special techniques that we think are most useful in pharmacy--the Latin Square, Full Factorials, Incomplete Factorials and Confounding, along with some of the special methods used in Taste Tests, etc. These methods we illustrate with some twenty-five or thirty examples from the literature and our own laboratories plus a number of fictitious examples to fill in. Calculating techniques are included, too, since few are described well in the texts.

Following the Physical Pharmacy we have a course called Product Development. In this we present no new basic theory or test methods but combine those already presented in order to attack specific problems. Here we delve into typical complex pharmaceutical problems. Almost no information of the type required is available in the literature. For example, the moment we attempt to discuss or set up tests for the stability of an emulsion or suspension we find that there is no reliable or generally accepted test. Here we have to theorize and discuss the various tests that have been described, try to find the strong and weak points of each and select one or more methods that may seem useful. Certainly this course is one which makes the student aware of the complexity of the problems he faces.

To attempt in the course in Product Development to cover all known types of pharmaceutical products would be ridiculous, and would require an enormous amount of time. Thus we select the types which seem best to illustrate to the student the applications of his knowledge. I feel that the chief problem in teaching a course of this type is that no one teacher is capable of presenting adequately the variety of topics that should be presented in this course, particularly since the level of training is so high. I believe that teaching of this course should be a joint effort of several faculty members, each one specializing in a limited number of topics.

Our aim in this curriculum has been to prepare a student for pharmaceutical research. In these courses we attempt to teach the application of scientific principles to pharmaceutical materials and to interpret the findings. During these courses, however, the experiments are quite limited in scope. It still remains to teach the student to integrate his bits of knowledge into a full scale research project, and I know of no way for

a student to learn this except by doing research.

It is still a surprise to me to see a student so thoroughly trained and so frequently reminded of the fallacy of empirical methods start out on his research problem expecting to solve it with the shallowest of thinking and planning. The majority still have the attitude we have mentioned before: let's try substances A and B and see if they work; if they don't work we'll try C and D, and so on. To combat this type of thinking and get the student started on the right foot, we have him write a research proposal. First he is asked to outline the project, the outline including in brief form a statement of the problem, reasons for its importance, a literature survey and the method proposed for solving the problem, with reasons why. This, incidentally, is good preparation for later times when he has to sell ideas and projects to management. It is gratifying to see how much a student learns in preparing this outline. It seems the most effective way to get our basic idea of deeper thinking across. Some students have rewritten these outlines after further library research six or eight times, and at least one took six months of reading, studying and rewriting, along with hours of discussion before he was prepared to write a good outline. We then discuss the outline with the student in informal conference and attempt to improve and correct wherever possible. As would be expected, the outline of methods of attack of the problem and the theoretical basis for the plan are usually the points needing the most effort, and these are the parts that have to be rewritten so often. Finally, after the outline is approved, the student writes the proposal in more detail and presents it orally at a seminar.

Because of the long series of courses that the student takes in this program, it is necessary to start him on research before the course work is completed. Also, we feel that it is good for the student to be assigned a research project at the very beginning of his graduate study, for, although he may accomplish no more than to complete his literature survey and conduct a few exploratory experiments in his first two years, we believe that it is good for him to be looking at his course work to see how it might be useful to him in his research. In addition, when he is able to spend larger amounts of time in the laboratory he has a pretty good idea as to what he's going to do.

Throughout his graduate study the student is scheduled for a regular conference with his research director once a week. Of course, there are the frequent visits to the research director for needed help by those active in research and the

usual visits by the advisor to the laboratory. We find that by having the student appear at the advisor's office for a more formal weekly conference the student comes prepared with a fair summary of his work to date. Thus, he has brought his recent work into focus with that done earlier and by doing so maintains his sense of direction. This conference is especially useful for discussing theoretical aspects of the problem.

Our seminar in pharmacy is used for several purposes. The general idea behind it is to develop the graduate student's interests over the entire field of pharmacy rather than just on his own problem. We have each student present his research proposal at a seminar; thus all students become familiar with the research topic and the planning of the program. It is quite common to receive useful suggestions and criticism from the other students. The open discussion will usually bring out any weak points, and to defend his research plan the student making the presentation has to know his subject well.

Periodically the students will summarize their research progress at a seminar meeting, and the results will be discussed by the group. This also is quite beneficial to the student making the presentation, for it requires him to collect his data and re-examine it in the light of his original ideas.

We use the seminar also for literature articles or groups of articles which are of special interest. In these meetings we usually assign in advance the references for all the students to read, and the following week we discuss them in informal manner.

The seminar is used to bring in men from industry to talk to the students about various phases of pharmaceutical research. This type of meeting has been disappointing, however, for it is difficult to get these men to give much detail on specific problems or accomplishments. We do believe that this situation will improve with time.

This then is our answer today to the training of men for the pharmaceutical industry. If we are active people you can expect this program to be continually changing--for the better, we hope.

Whatever the details of the various graduate programs, I hope that the colleges of pharmacy will recognize the challenge and put pharmaceutical research at the high level it belongs.

**Discussion:** No discussion was recorded following this paper.

## A GRADUATE PROGRAM FOR TEACHERS OF PHARMACY

Glenn L. Jenkins

Purdue University

Since this Seminar is devoted to pharmacy rather than all pharmaceutical sciences, we will consider this subject on the restricted basis or, in other words, preparation for teaching the subject matter area covered by this Seminar.

It is quite obvious that the improvement of professional education in pharmacy is based on three major fundamentals in the following descending order of importance: 1. adequate physical facilities, 2. the quality of the students, 3. the quality and the quantity of the faculty.

Each institution usually provides physical facilities of the best quality possible within its financial means. The students in our schools represent a cross-section of American youth comparable to students in the other sciences, technology, and in the other professions. In view of the intense competition for superior talent, there is little hope that we can upgrade our professional objectives by securing a greater share of the preferred students. We may do well if we maintain the status quo. Consequently, it becomes evident that the best procedure for upgrading our total educational process is through the improvement of our faculties in quantity and in ability to give highly competent instruction.

Most institutions of higher learning have given considerable attention to the improvement of instruction in recent years. However, it remains true that the departments of education within our universities are geared primarily to the training of teachers for the primary and secondary schools. Efforts to improve the quality of instruction in such areas as chemistry, physics, biology and engineering have been made. Many of these efforts have been reviewed before these seminars conducted by the American Association of Colleges of Pharmacy. Likewise, fundamental learning concepts and fundamental teaching concepts have been reviewed. Consequently, there is available a great fund of information for those who want it if they are willing to seek it out.

Most of us who have been students or teachers for the major part of our lives have known a few truly great teachers who make lasting impressions upon the minds of students. These teachers have the ability to teach the subject well and in addition the rare faculty of vitally stimulating the

imagination and enthusiasm of the students and challenging them to develop their capacities to the fullest. On the other hand, most of us have known some truly poor teachers whose apathetic attitude and slipshod teaching methods arouse a feeling of resentment and frustration on the part of the students resulting in a thorough dislike of the instructor as well as the subject. Somewhere between these two great extremes from eminence to mediocrity lies the great body of teachers who are not long remembered because they are neither particularly good nor particularly bad. They might be called the average teachers, but steps can be taken to make better teachers of average teachers, and this must be done if the objectives of pharmaceutical education are to be accomplished. One approach is through better graduate training for teaching.

The interest in programs for training graduate students for college teaching is becoming increasingly evident. On the one hand we have attractive opportunities for our scientists to accept industrial or governmental positions drawing potential good teachers away from academic careers. On the other hand, we have the increasing tendency on the part of college administrators and other agencies concerned with teaching to stress better teaching. This latter tendency takes the form of teacher evaluation charts given to students who rate their instructors on the various factors listed. Likewise, alumni often are asked who their good teachers were.

The American Council on Education and the United States Office of Education have sponsored conferences on improvement of college teaching.

References:

---

1. Blegen, T. C. and Cooper, R. M. "The Preparation of College Teachers", U. S. Office of Education. 1949.
2. Kelly, Fred J. "Improving College Instruction", U. S. Office of Education. 1950.

---

These excellent reports and others such as result from these seminars are available, but unfortunately few of the young people preparing for a career in teaching ordinarily see them. They go only to presidents, deans, department heads and others. Likewise, few of the young graduate students in training for teaching have an opportunity to attend the conferences or the seminars.

The Committee on Graduate Instruction of the Council on Graduate Work of the Land Grant College Association has been studying the problem of preparing college teachers. Questionnaires sent to 86 departments revealed eleven departments, or

13% of the total, reported that their students take courses concerned with training for college teaching or that courses are available for them. Twenty departments, or 24% of the total, reported that seminars dealing with training for college teaching are available. Seven universities out of twenty-five offer an opportunity to take courses dealing with college teaching, and twelve of the twenty-five provide an opportunity to participate in seminars. In some universities both courses and seminars are available.

---

3. Russell, Walter C., "Report of the Committee on Graduate Instruction of the Council on Graduate Work of the Land Grant College Association, 1951".

---

The most widely used procedure affording an opportunity for at least some graduate students to prepare for teaching is through predoctoral teaching experience. The so-called teaching assistantship is extensively used in laboratory and recitation instruction. In the land grant colleges it is reported that sixty per cent of such teaching is supervised and that the teaching load of the supervisor is decreased to permit time for supervision.

Numerous institutions report courses in training for college teaching. Usually such courses are not required but they are elected as a minor or part minor by students. Courses of this kind usually are taught by the faculty of the School of Education. Typically, courses are given under such titles as, "The College Students", "College and University Teaching", "The American College and University", and "The Construction and Use of Objective Examinations". Such courses are often not in addition to the regular doctorate program but are a part of it. Some schools also offer what is known as the Teaching Procedures Seminar and College Teaching Studies where students observe, study, and demonstrate procedures in their field. In the college teaching studies done in connection with actual college teaching assignments the students work out some concrete aspect of teaching aims, procedures, or evaluation.

Certain areas, for example engineering, (See "The Self Education of Young Engineering Teachers" by L. W. Gleekman, Journal of Chemical Education, 30, 416 (1953) have through committee studies and otherwise made an effort to assist in the advancement of younger members of the teaching profession by providing the means to find assistance, expression, and the responsibility to advance themselves. Such efforts are in line with the objectives of this Seminar, the teachers' conferences held before the A.A.C.P., and other activities in

pharmacy. The major difficulty is that those who need to attend most often find it least possible to do so by reason of assigned duties and expense. Ways and means to enable young graduate students and instructors to attend seminars and teachers' conferences should be explored. At the same time individual institutions can do much in the way of self education of their staff by providing seminars on campus, supporting study at other institutions, providing allowance in the teaching load so that the young instructor may take courses in education, speech and other subjects that will supplement his background for instructional purposes.

The problem of designing a graduate program for teachers of pharmacy has many facets:

1. The graduate student. A study of the records reveals that the graduate student usually comes from the upper third of his high school class and the upper fourth of his college class. When we consider the elimination process of our system of education, it is found that the individual who completes the graduate program to the doctorate level comes from the upper five percentile of individuals who enter our schools. Likewise, examination of the records reveals that a substantial number of these individuals have excelled in extracurricular activities which should make for the development of qualities of leadership. Nevertheless, a few of them have been the student type who concentrates on studies and neglects extracurricular and social activities. In my opinion the undergraduate program in pharmacy is superior to most curriculums in providing the kind of education needed by a cultured individual in this age of science and technology. Most of those selected for graduate work have secured an excellent general education.

The graduate student majoring in pharmacy has completed the B. S. in Pharmacy at an accredited college and usually has fulfilled one year of experience so that he is qualified as a licensed professional and is a mature individual.

2. The graduate program in general. The graduate programs in most of our institutions must meet the requirements of the Graduate School. In general the minimum consists of three full academic years of work equivalent to 144 quarter credits or 96 semester credits after the Bachelor's degree. The individual program for a student is usually constructed with the approval of an advisory committee and the Graduate School

Graduate education in all areas of science in our country has been set up according to the general pattern expressed

in minimum credit hours for record keeping about as follows:

	M. S.		Ph. D.	
	Courses	Research	Courses	Research
Major	12	6	24	48
1st Minor	6		12	
2nd Minor	6		12	
Totals	24	6	48	48

Completion of the M.S. degree requires not less than one academic year, and for the Ph.D. degree, three academic years. These minima in credits and time often are increased by 25 to 50 per cent in certain areas and for some individuals. In addition, a reading knowledge of one foreign language for the M.S. and two foreign languages for the Ph.D. usually is required. Student performance often is increased in quantity per unit credit about 25 per cent above that expected in undergraduate work and in quality to a minimum represented by grade B.

3. The individual student's program. The program for each student usually is worked out to assure high proficiency in a specialized area (the major) supported and strengthened by additional studies in related fields (the minors).

The Ph. D. degree has become almost a universally required prerequisite to entry and progress in the field of professional and scientific teaching. If we use the term "philosophy" as embodying a broad knowledge and understanding of phenomena and their causes, which may properly include human nature and conduct as well as phenomena in inanimate systems or simple plants or animals, one who has attained the degree of Doctor of Philosophy with a specialty in pharmacy as a major should have an excellent background for teaching. A satisfactory background, however, and full qualifications for entry into teaching are quite different matters. In undertaking to prepare teachers we must remember that the Ph. D. program is still an individual one and can be very broad in scope, but it is most likely to be limited to the field of specialty with supporting minor areas of study.

An elementary study of 29 graduate students majoring in pharmacy who completed the work for the doctorate degree at Purdue during the last decade reveals the following data: Eleven entered industry and eighteen entered the field of teaching. In addition to the eighteen who entered the field of teaching and who majored in pharmacy, six individuals who majored in pharmaceutical chemistry are teaching primarily pharmacy subjects. All of the twenty-nine who majored in pharmacy supplemented their studies in that area either as a

a part of their major or as minor subjects by work in the areas of pharmaceutical chemistry or pharmacology. All of them were required to take at least a half minor outside the School of Pharmacy. The median program exceeded the minimum requirements of the Graduate School by 12 semester hours. In other words, it required the students the equivalent of 6 2/3 semesters to complete the requirements for the doctorate degree (without including prerequisites or language requirements). Programs included minor work outside the School of Pharmacy distributed as follows: Chemical engineering, 6; general engineering (usually Time and Motion Study), 7; physical chemistry, 12; statistics, 2; biochemistry, 2; economics, 2; English, 2; and education, 6. Under the heading of "Education" the subjects usually taken include the "Psychology of Learning and Teaching Applied to College Work" and "The American College and University"; two courses worked out by a committee of the Graduate School to provide for training in college teaching and available for graduate credit without prerequisites except for the bachelor's degree. Many had other single courses outside the School of Pharmacy. All but seven of the twenty-nine individuals had experience in teaching as a graduate teaching assistant or as an instructor.

In recent years we have attempted to embark on a definite program of training for the teaching profession as well as for preparing individuals for high proficiency in a limited area of specialization. This attempt presents certain problems and in some instances we have developed a partial or satisfactory solution. Some handicaps are:

(a) The major field of pharmacy is not a clearly defined single entity. Rather, it is a hybrid of many sciences. Such specialties as industrial pharmacy, hospital pharmacy, product development and formulation, theoretical and physical pharmacy, history and literature are specialties within a specialty. The need for a broad background in the physical sciences for the teacher of pharmacy makes it difficult to add specialization for teaching to the specialization in the science and technology of pharmacy.

(b) The pressure of time and money induced many promising potential teachers to accept fellowships which permit full-time graduate work rather than assistantships or teaching fellowships which would give experience.

(c) The teaching assistant often is subordinated to routine duties and uninteresting assignments.

A program for accomplishment that will aid in the training

of better potential teachers and improve the performance of young as well as mature staff members may be developed in many ways. The program we have designed and at least partly put into practice may be set forth as follows:

(1) Each faculty should search out and encourage in every way possible those students who have the necessary qualifications and who wish to enter the teaching field. Nevertheless, the number of beginning graduate students who can declare such an intent will always be small. Many of the most promising prospects for university faculties come from those students who discover in the course of their own graduate teaching assistantship and research an interest in teaching and in fundamental investigation. The student is investing his time and effort and has a right, so long as he can show that his program and objective are logical and sound, to select his major and his supporting minors. The Graduate Advisory Committee can guide him but can hardly compel him to prepare for work in the area of teaching.

(2) A number of graduate teaching assistantships have been established on a part-time basis for beginning graduate students. The assistant is allowed to carry a two-thirds graduate load and is assigned duties totalling not to exceed 20 hours per week. These graduate assistants are paid \$150 per month, fees equivalent to \$500 per year are waived, and there is no charge for breakage or supplies. The stipend paid plus other allowances is roughly calculated as equivalent to \$2400. Calculated to a fulltime basis for an instructor, we consider that this pay is equivalent to \$5400 per academic year. Thus it is evident that the assistantship system is not particularly an economical method of instruction. Graduate assistants are not permitted to hold other appointments or engage in other outside work.

(3) At a meeting of the fulltime faculty and the teaching assistants at the beginning of each year the total educational program is discussed and the duties and responsibilities of the faculty and the assistants are described. Each graduate assistant is given a copy of the manual "Effective Teaching", designed for engineering instructors which can be applied equally well to instructors in pharmacy.

(4) Each graduate assistant is assigned to a professor who acts as his preceptor.

(5) Each member of the faculty is expected to meet at least once each week with his assistants, discuss the class room and laboratory assignments, point out any instructional

work that offers particular problems and those things that deserve special emphasis. Also at these meetings the specific duties of the assistant that differ from the usual are pointed out.

(6) Each professor is expected to give his assistant instruction and experience in such simple matters as taking classroom and laboratory roll and maintaining same, assignments to seating and to laboratory desk space, checking in and checking out lockers, preparing and making available laboratory supplies, reagents and samples, checking off and grading laboratory notebooks and papers, maintaining discipline and good housekeeping in the classrooms and laboratories, preparing and setting up lecture and laboratory demonstrations, and other duties that may seem simple but that in reality may be quite difficult in an effective program.

(7) Emphasis is placed on utilizing the laboratory as an effective means of instruction. The assistant is not simply to attend and to answer questions, but each student is to be visited each laboratory period and asked direct questions concerning the work he is doing, and be given instruction and advice. In other words, each student gets at least one personal contact each laboratory period. To accomplish this end in all areas assistants are assigned in a ratio of 1 staff member to as many as 18 students in analytical chemistry, but in areas such as Manufacturing or Senior Dispensing there may be one assistant to each 6 students. The professional staff member in charge is expected to visit each laboratory for a part of each period.

(8) Seminars dealing with instruction are conducted on a weekly basis. The construction of the curriculum, the development of syllabi, and means to improve instruction are general subject matters. Usually the seminar is led by a fulltime staff member who presents a discussion of a subject for approximately 20 minutes, and that is followed by a round table discussion in which the teaching assistants participate. Such seminars are required of all graduate students whether they expect to enter teaching or industry, since all of those who go into teaching or research have a basic teaching job to do at some time in their lives.

(9) The graduate student is expected to prepare and deliver at least one lecture before the class each semester. He not only outlines and plans the lecture on a selected subject but develops the best possible methods to employ, e.g., the use of slides, charts or blackboards, and devises the method of stimulating interest on the part of students in the

work he presents. All of this is checked by the professor and the lecture is given under supervision. Care must be exercised in this part of the program to prevent subjecting undergraduate students too much to instruction by inexperienced teachers.

(10) The graduate assistant is supposed to assist in the construction of examinations and grading, always under supervision. At the end of the course he is asked to assist in the adjustment of grades.

(11) Those students who have unusual ability and appear to have aptitude for teaching are advised to secure at least some professional educational courses in their program of study.

(12) During the assistantship work any deficiencies such as in speech, distracting habits, or objectionable characteristics are pointed out to the assistant and remedial work is recommended.

(13) The preceptors are asked to rate the assistants and the ratings are used in part as a basis to encourage the student to enter the teaching field and in part for recommending students for fellowships after they have completed two years of the assistantship program. Appointment to a fellowship under which a student can pursue fulltime graduate work is considered to be a promotion.

(14) Other qualities that can be developed include: an empathy with the teaching staff, a change in the attitude that "the course was tough when I took it and I'm going to make it tougher," "I'll show these fellows how much I know," "I hold the knife now and I'll draw my share of blood," and the creation of an attitude of understanding with suspension of judgement.

A primary dividend accrues to the teaching personnel of a school when there is a continuing program devoted to the improvement of instruction. Informal as well as formal group discussions create a feeling that good teaching is recognized properly and this feeling has a marked stimulating effect on the entire staff.

A secondary dividend of far-reaching importance can be achieved if it is emphasized that each professional subject should be taught for its liberal educational and cultural values. History of Pharmacy, Ethics, Dispensing and even the Arithmetic of Pharmacy can be taught with deadly dullness or

they can be taught as dynamic subjects related to the civilizations of ancient, medieval, and modern times, and social and economic change as well as the industrial and scientific revolutions of our days.

In summary, much can be accomplished by improving the training of graduate students in pharmacy for careers in teaching. The best results, however, will be obtained by a multiple approach that does not place all of the burden on the graduate program. Approaches that might be employed include:

1. An assistantship or apprenticeship program similar to that described. Admittedly, it can be no more effective than the interest, aptitude and team work between the administration, the graduate assistants and the preceptors. It is not the answer to all problems in teacher training in pharmacy, but it is a step in the right direction.
2. Most graduate students should serve as assistants until they attain the equivalent of the M. S. degree, since most of them will engage in a teaching activity either in schools, in government, industry or elsewhere. The program would be strengthened if foundations and other agencies did not award fellowships directly to those who hold the B. S. degree except under unusual circumstances.
3. Teaching fellowships should be provided for those students who acquire an interest in teaching after securing the M. S. degree.
4. At least a half minor in education equivalent to 6 semester hours should be made available to all students as a part of their program of courses or as a substitute for one language.
5. A standing committee on the Improvement of Instruction should operate actively in each pharmacy school. One function of this committee should be to stimulate an interest in better teaching in every way possible.
6. Seminars sponsored by the Graduate School, the Department of Education, or the pharmacy faculty should be made available and should be utilized fully.
7. A reduced teaching load for the young instructor making it possible for him to take courses in speech, education, psychology or other areas that will lead to his self improvement and strengthen his specialty as well as build stronger teaching techniques should be a part of the program.

A combination of all of these means undoubtedly would improve our total educational program in pharmacy.

I do not like to conclude on a pessimistic note. It should be pointed out, nevertheless, that a five-year undergraduate program, one year of experience for licensure, two years in the armed forces, and a combined experience and graduate study program of four years--a total of 12 years--cannot be expected to appeal to the intelligent young people we want as teachers in pharmacy unless we can upgrade greatly the economic status and the challenge offered by pharmacy in competition with the other sciences and professions.

Discussion: No discussion was recorded following this paper.

#### GENERAL SUMMARY AND REVIEW OF SEMINAR

Melvin W. Green

Director of Educational Relations  
American Council on Pharmaceutical Education

Like most of you, I suppose, I find myself so close to the scene and with so many impressions crowding in on each other that it will be easier to sum up the conference when I am several weeks and a few hundred miles away from Indianapolis. Before I go further, let me say that this evaluation is made possible, in part, due to the faithful reporting of the afternoon workshop sessions by the members of the Butler staff. In addition many of you have contributed to this summary, unwittingly, by your observations and comments.

Dean Kaufman and members of the Butler staff, I feel sure that I express the unanimous opinion of the group in saying that detailed planning and the superior facilities that you have made available to us have contributed immeasurably to personal comfort and to the success of this seminar.

At the opening of this seminar Dean Sprowls reminded us of the objectives of such a seminar as visualized by the Pharmaceutical Survey which will bear repetition. "The purpose ...is that of providing needed opportunity for the members of the teaching staffs and for graduate students to come into fruitful contact and to keep pace with progressive content and methods of instruction." How do we measure up against such a yardstick? Aside from the fact that very few graduate students are present, I would say that we look good. The contact has been frequent and fruitful. I do not believe that there is a seminarian present who will not take home a useful idea and many of us will take home literally dozens. Apropos of this

may I say that probably some of the most fruitful of these contacts have been at the dinner table, on the front steps, or in one of the seminarians' rooms rather than in the halls of formal contact. It was ever so.

Dean Sprowls also charged us with the responsibility of keeping ourselves student centered. Our student-centeredness is obviously a question of degree, but I believe that most of you will agree that, in the long run, we have followed the directive.

In the case of the directive to stick to the question of "how to teach" rather than "what to teach", I suspect that we strayed further from the fold. But in this period of transition, I am inclined to believe that we can justify the delinquency.

To me some of the most productive discussions revolved around the more quantitative approaches to pharmacy. Many other fields have gone through just such a transition. When bacteriology placed the microscope in a secondary position to the test tube and microrespirometer it became an adult and productive science. Physiology and anatomy had to go from the purely descriptive to the functional to reach adulthood. Botany gained when it shifted its major interest from taxonomy to phyto-physiology and biochemistry. There was a day when drug therapy was sufficiently stable, and I might add, sterile that pharmacy could be descriptive and almost totally an art. It seems to me that the rapid influx of modern drugs and the increased number of pharmaceutic adjuncts means that descriptive pharmacy can no longer effectively cope with the situation.

This seminar has held long and, at times, rather pedantic debates on nomenclature, integration vs. separation, credit hours, sequence and prerequisites relative to the physical approach. I hope no one will become discouraged if at times the discussions seemed to shed little light--they at least were attended with little heat. While little seems to have been settled by these discussions, I believe that actually great gains were made. To me it seems now a settled issue that a new approach to pharmacy, the quantitative and physical is here and other phases of the discussions are secondary to that fact. Regardless of what this area is called or how it is arranged, the significant fact to me and, I believe to most of you, is that a new way of thinking pharmaceutically is being born. As these secondary factors are being ironed out over the years, the productivity of this approach will become more and more appreciated.

With regard to these areas, I wish to make another

observation. We have not long before the extended program will be upon us. Regardless of the pattern that your particular institution will inaugurate, the practical dictates of course sequence will mean that it is in essence a 2-3 plan. To put it in other words, students will be college juniors before they start any significant professional education. Natural processes of attrition will have wiped out the poorer students and you will be confronted with a more or less mature student. If pharmacy courses fail to challenge the student, the loss in morale and professional attitude will be detrimental. This is another and important argument for the more quantitative approach.

Those of us whose hairs are grayer or more sparse have heard difficulties in pharmaceutical arithmetic teaching discussed almost ad nauseam. It seemed to me that a real approach to understanding our difficulties was reached as far as failures due to the proper understanding of the relationship of numbers is concerned. It has been my personal observation in relation to teaching in this area that the difficulties arise from 2 factors: the inability to manipulate numbers easily and accurately and the lack of ability to visualize the phenomenon being calculated. In this area I was gratified to learn of at least a few instances where visual aids are being used to try to overcome this difficulty. I believe more discussion of this phase of arithmetic teaching would have been fruitful.

Several papers and considerable discussion revolved around what may be termed specialized pharmacy. I am thinking of hospital pharmacy, pharmaceutical manufacturing and various pharmacy electives. I was particularly pleased to see hospital pharmacy on the program, for this area is being educationally neglected to too great an extent in my judgment. The increased importance of the hospitals in our social milieu and the professional contacts that hospital pharmacy affords are too important to be overlooked. We must not meet the educational needs in this area with too little, and too late. The time to arrive at important concepts and decisions in this area is now. As I listened to the discussions in these various areas and interpreted them in light of my own observations and philosophy of education certain ideas came to mind which may not agree with your conceptions, but which I believe should be said.

First I come back to an attitude which I believe many of you have heard me express on, perhaps, too many occasions: it is the task of the college to be constantly vigilant in separating those skills that should be learned on the job from more fundamental techniques and concepts that can be learned only in the college. I cannot believe, personally, that one can teach beyond the rudiments of a skill without the risk of

sacrificing collegiate education for vocational education. It seems to me that the real help that the colleges can be in such areas as manufacturing pharmacy and hospital pharmacy is in teaching thoroughly, and probably in most cases more thoroughly than now, the fundamental principles underlying such skills; orienting the student to the basic rudiments of the specialized fields; and assisting as professional educators in the on-the-job phases of training and in research. It is true that in all of the professional fields we must continue to depend upon the members of the profession to take an even greater measure of responsibility in the continued training of the novice.

Second, I am wondering if our thinking is not too closely oriented toward the unquestioned fact that 80 per cent or better of our graduates are going into the retail field. What will happen if we ignore that concept and in its place develop the philosophy that we are training and educating pharmacists, not retail pharmacists, just pharmacists, and that our education core is such that the resultant product can go into any phase of pharmacy and, after the initial field experience and indoctrination that must be had in any vocation, can measure up to his personal potentialities in his chosen area.

We keep hearing on all sides that scientific and professional people such as ourselves run the constant danger of becoming more narrow in our outlook. No doubt our critics would have been surprised, and I hope, pleased to see on our program papers on the nature and purpose of history of pharmacy and ethics as well as workshop sessions in these fields. In times when the profession is beset with the results of social forces which many of us find difficult to understand and when ethical relations within and without the profession torment us every day, such papers and discussions are indeed welcome. In the area of professional history very few are qualified in the same sense as the teachers of the more technical subjects. Bibliographic aids, guides to audio-visual material and lucrative discussions by those better qualified were especially helpful in this area in stimulating the development of courses that may be not only better historically, but make it possible to broaden the scope of such courses in terms of the social significance of pharmaceutical affairs.

Tied to these latter papers are those of Deans Wilson and Daniels on the teacher and public relations and the teacher and professional attitudes. Certainly the teacher who is conscious of his relations to the public, in the better sense, and the one who constantly reminds himself that he is a part of an ancient lineage of honorable pedagogs is doing a better than average job.

During this week many stimulating ideas have been presented. How many will be carried out? That is dependent upon the determination of most of us, yes, but beyond that a rosy future can be assured only if a continued flow of properly trained and zealous young teachers can be assured. It is proper, then, that this seminar should close with a realistic look at the graduate side of the picture. Several papers were presented showing on the one-hand, concern for the need for graduate work in pharmacy and in specialized areas of greater depth and significance and, on the other hand, need for increased and careful recruitment of graduate students. As Dr. Busse has stated "A profession which permits a significant portion of its members to work at levels below their capabilities is failing to achieve its potential strength. The ability of a profession to progress, the ability to better the goals for which it strives, and the skill and wisdom with which it meets its challenges are likely to be decisive factors in determining its fate. The goals of a free profession are determined by its members and the wisdom of the profession is the wisdom of its members. Thus a profession can attain its full potential only when each of its members is enabled to contribute as fully as his individual abilities permit. It behooves all of us, therefore, to give of our time, energy and effort to encourage and inspire as many of our capable young pharmacy graduates into graduate work as is possible."

In keynoting this seminar Dean Sprowls reminded us that the primary objective of this seminar is wrapped up in improving our teaching. No more fitting closure can be found than Dean Stephen Wilson's 3 functions of a twentieth century teacher.

- "1. He must transmit the accumulated knowledge of the past and interpret it with references to the present.
- "2. He must be able to take this knowledge of the present into the future, because he is guiding his students in a society always evolving. At the very least, the teacher must understand major trends in contemporary civilization, and prepare the young to meet adequately the problems they will encounter as they approach maturity.
- "3. He must augment the first and vitalize the second by adding to the accumulated store of knowledge by thorough research."

Let this be our Hippocratic oath!

Comments: The Chairman thanked the Seminarians for their attendance and participation throughout the sessions and closed the Seminar of 1955.

Seventh Annual Teachers' Seminar

## Registrants and Participants

Andrako, John-U.of N.Carolina	Granberg, C.B.-Drake U.
Armacost, R.R.-Purdue U	Greco, S.J.-Geo. Wash. U.
Autian, John-Temple U.	Green, M.W.-Director, Ed. Rel.ACPE
Barr, Martin-P.C.P.&S.	Grolle, Floyd-U. of Mich.
Bartilucci, A.-St. John's U.	Grosicke, T.X.-U. of Ark.
Bauman, H.P.-State U.of Iowa	Groves, G.A.-U. of British Col.
Beck, A.V.-Butler U.	Guess, W.L.-U. of Texas
Beck, Mrs.A.V.-Butler U.	Guth, Earl-Ohio State U.
Belcastro, P.-Purdue U.	Hadley, W.J.-U. of Minn.
Bhatia, V.N.-Wash. State C.	Hammarlund, E.R.-Wash. State C.
Bianculli, J.A.-U.of Pittsburgh	Harwood, A.A.-Butler U.
Bingenheimer, L.E.-U. of Tenn.	Harwood, Mrs.A.A.-Butler U.
Blaug, S.M.-State U.of Iowa	Hastings, J.T.-U. of Ill, Education
Bliven, C.W.-Geo. Wash. U.	Hayman, J.L.-U. of W. Va.
Blockstein, W.L.-U. of Pittsburgh	Hewitt, H.G.-U. of Conn.
Boenigk, J.W.-Medical C.of Va.	Higuchi, T.-U. of Mich.
Briggs, W.P.-Director AFPE	Hopkins, Samuel-Lea and Febiger Co.
Brodie, Don-U. of Calif.	Hubbard, Dorothy-Butler U.
Brown, Jean-U. of Okla.	Hubbard, Donald-Indiana U
Burlage, Henry-U. of Texas	Hunter, J.E.-U. of S. Carolina
Busse, L.W.-U. of Wis.	Husa, Wm.J.-U. of Florida
Chambers,M.A.-S.College Pharm.	Huyck, C.L.-St.Louis C. of Pharm.
Christian, J.E.-Purdue U.	James, Emory A.Jr.-Howard U.
Clark, R.W.-U. of Okla.	Jenkins, G.L.-Purdue U.
Coker, Samuel T.-U. of Miss.	Jones, H.M.-Texas Southern U.
Coulson, Roger-Butler U.	Kahl, R.J.-U. of Wyoming
Cronk, Dale-S. U. of Iowa	Kahl, Mrs.R.J.-U. of Wyoming
Daniels, T.C.-U. of Calif.	Kayser, J.W.-St.Louis C. Pharm.
Darlington, Roy-Howard U.	Kaufman, K.L.-Butler U.
Data, J.B.-Purdue U.	Kaufman, Mrs.K.L.-Butler U.
DeKay, H.G.-Purdue U.	Kearns, J.H.-Rutgers U.
Doerr, D.W.- U. of Ill.	King, L.D.-Rutgers U.
Drummond, Fred G.-U. of Colo.	Koepper, Lydia-Butler U.
Dunbar, J.B.-U. of Ill.	Lach, J.L.-S. U. of Iowa
Easterly, W.D.-U. of Ark.	Lee, C.O.-Ohio Northern U.
Easterly, Mrs.W.D.-U.of Ark.	Lee, Mrs.C.O.-Ohio Northern U.
Eisen, Henry-St.John's U.	Lemberger, Max N.-U. of Wis.
Elowe, L.N.-U. of Toronto	Lemeshka, Ted-Rhode Island C. Ph.
Escabie, R.S.-U.of Puerto Rico	Lemeshka, Mrs. Ted & Son- "
Ferring, L.F.-Xavier U.	Lesshaft, C.T.-U. of Ky.
Flack, Herbert-PSP&S	Lloyd, Wm.-U. of Texas
Fonda, Lyman-Brooklyn C. Pharm.	Lloyd, Mrs. Wm.-U. of Texas
Fonda, Mrs.Lyman	Lofgren, F.V.-U. of Texas
Foss, N.E.-U. of Maryland	Lord, Roger-U. of Montreal
Geiler, F.L.-U. of W. Va.	Lundeen, Mrs. Ethel-Butler U

McCloskey, J.T.-Loyola U.  
 McConnell, W.E.-U. of Mich.  
 McEvilla, J.D.-U. of Pittsburgh  
 Marcus, Arnold-Rutgers U.  
 Martin, A.N.-Purdue U.  
 Martin, J.W.-Butler U.  
 Martin, Mrs.J.W.-Butler U.  
 Mattocks, Albert-U. of Mich.  
 Meyers, D.B.-Butler U.  
 Meyers, Mrs.D.B.-Butler U.  
 Michener, N.L.-Butler U.  
 Michener, Mrs.N.L.-Butler U.  
 Mills, James-Brooklyn C.Pharm.  
 Morrison, F.A.-U. of British Col.  
 Morrison, R.T.-Drake U.  
 Mull, B.R.-Butler U.  
 Mull, Mrs.B.R.-Butler U.  
 Mulvey, R.K.-Wayne U.  
 Netz, C.V.-U. of Minn.  
 Neuroth, M.L.-Med. C. of Va.  
 Newcomb, J.C.-U.of Pittsburgh  
 Niles, E.H.-Butler U.  
 Niles, Mrs.E.H.-Butler U.  
 Osborne, George-U. of Utah  
 Parrott, E.L.-U. of Arizona  
 Parrott, Mrs.E.L.-U. of Ariz.  
 Patel, B.N.-St.John's U.  
 Peterson, Charles-U. of Kan.  
 Peterson, Mrs. Charles & 3  
     children  
 Plaxaco, James-U. of S. Car.  
 Plein, Elmer-U. of Wash.  
 Plein, Mrs.Elmer-U. of Wash.  
 Putney, B.F.-Rutgers U.  
 Ramstad, Egil-Purdue U.  
 Raubenheimer, H.C.-New Eng.  
     College of Pharm.  
 Ravel, Kanak-S. U. of Iowa  
 Ray, Wm.H.-Purdue U.  
 Rowe, E.J.-Butler U.  
 Rowe, Mrs.E.J.-Butler U.  
 Rowe, Tom D.-U. of Mich.  
 Sager, R.W.-U.of Pittsburgh  
 Salisbury, R.-Ohio State U.  
 Schleif, R.H.-St.Louis C. of Ph.  
 Schobel, Wm.-Butler U.  
 Schroeter, L.C.-St.Louis C. of Ph.  
 Schwartz, Charles-Southwestern  
 Schwartz, Mrs. C. and 2 children  
 Sciarra, J.J.-U. of Maryland  
 Semeniuk, Fred-U. of N. Carolina  
 Seybert, J.E.-Indianapolis, Ind  
 Seybert, Mrs. J.E.- "  
 Shasheen, Robert G.-Duquesne U.  
 Sica, A.J.-Fordham U.  
 Slone, E.P.-U. of Kentucky  
 Smith, W.G.-U. of S. Calif.  
 Smith, Mrs.W.G.- U. of S. Calif.  
 Sonnedecker, G.-U. of Wis.  
 Sperandio, G.-Purdue U.  
 Sprowls, J.B.-Temple U.  
 Stemple, Edward-Brooklyn C. Pharm.  
 Street,V.P.-N. Dak. Agric. C.  
 Susina, S.V.-U. of Illinois  
 Swanson, E.E.-Butler U.  
 Swanson, Mrs.E.E.-Butler U.  
 Thompson, H.O.-U. of N. Carolina  
 Tice, L.F.-(Pres.AACP) PCP&S  
 Uhl, A.H.-U. of Wis.  
 Vincent, Muriel-Oregon State U.  
 Waldon, C.H.-Detroit Inst. Tech.  
 Waldon, Mrs.C.H. " "  
 Waldon, Colin-Detroit Inst. Tech.  
 Waldon, Curtis-Detroit Inst. Tech.  
 Walker, G.C.-U. of Toronto  
 Waters, Kenneth L.-U. of Georgia  
 Waters, M.T.-Fla. Agr. & Mech. U.  
 Webb, Norval-S. Dak. State C.  
 Webber, M.G.-U. of Houston  
 Wiese, G.A.-State U. of Iowa  
 Wilson, Ralph M.-Ferris Institute  
 Wilson, S.C.-Wayne U.  
 Wilson, Mrs.S.C.-Wayne U.  
 Winters, E.P.-U. of Ill.  
 Wuggatzer, W.L.-Rutgers U.  
 Wurdack, Paul-U. of Pittsburgh  
 Wurster, D.W.-U. of Wis.  
 Wurster, Mrs.D.W.-U. of Wis.  
 Zopf, L.C.-State U. of Iowa  
 Zopf, Mrs. L.C.-State U. of Iowa  
 Zuck, Donald A.-Eli Lilly,  
     Indianapolis, Indiana